# Municipal Engineering.

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## THE CHICAGO PLAN COMMISSION.

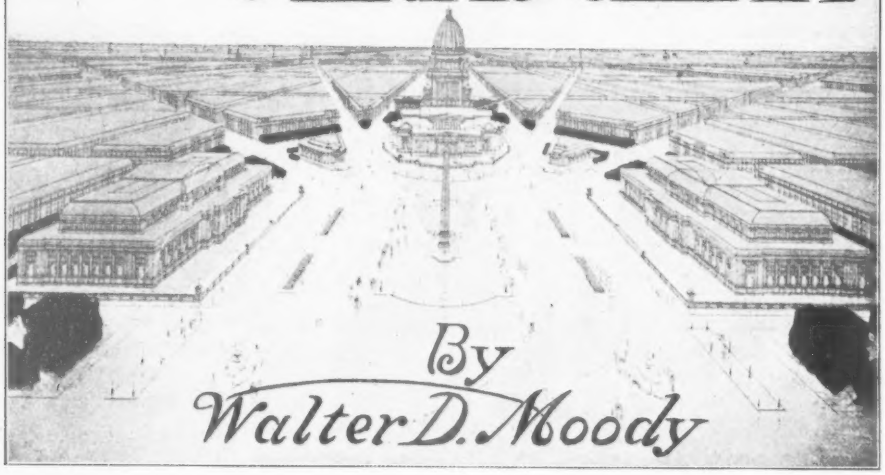
IN this issue we publish an article by Walter D. Moody, managing director of the Chicago Plan Commission, and written by him especially for MUNICIPAL ENGINEERING.

WALTER D. MOODY.

In 1907 the first Chicago Plan Committee of the Commercial Club was organized, with Charles D. Norton as chairman and Charles H. Wacker as vice-chairman. These leaders retained their respective offices until 1909, when Mr. Norton resigned to take up his residence in Washington, and Charles H. Wacker succeeded him as chairman of the committee. On July 6, 1909, Fred A. Busse, mayor of Chicago, sent a message to the city council requesting authority to appoint members of a permanent organization to be known as the Chicago Plan Commission. This authority was immediately granted, and on November 1, 1909, the mayor announced the appointment of three hundred twenty-eight citizens to form the first Chicago Plan Commission, and designated Mr. Wacker, who was the chairman of the Commercial Club Committee, to be permanent chairman of the new commission. At the first meeting of the commission Frank I. Bennett was elected vice-chairman, and Harry Bennett Chamberlain was chosen secretary pro tem., an office which he held until his resignation late in 1910. On January 13, 1911, the executive committee appointed Walter D. Moody, formerly general manager of the Chicago Association of Commerce, to be managing director of the Chicago Plan Commission. The plan of the commission, which is outlined by Mr. Moody in the following article, has been brought to the point of realization during the past year, due to the force of the personal efforts of the men behind the movement. The constant idea has been to adopt such a plan that all development and improvement should be along certain definite and prearranged lines, to the end that the necessary expenditures for public improvements from year to year may serve not only the purpose of the movement, but also the needs of the future. To assure the more intimate acquaintance of the city officials with the details of the plan, it was decided that members of the council and the heads of the various departments related to the work should be ex officio members of the commission.

The spirit that is making Chicago's Plan Commission a great factor in the city's progress is but the expression of the enthusiastic faith, self-confidence and fixity of purpose of its leaders, and to Mr. Moody is due no small amount of the credit for its success.—THE EDITORS.

# The Chicago Plan



By Walter D. Moody

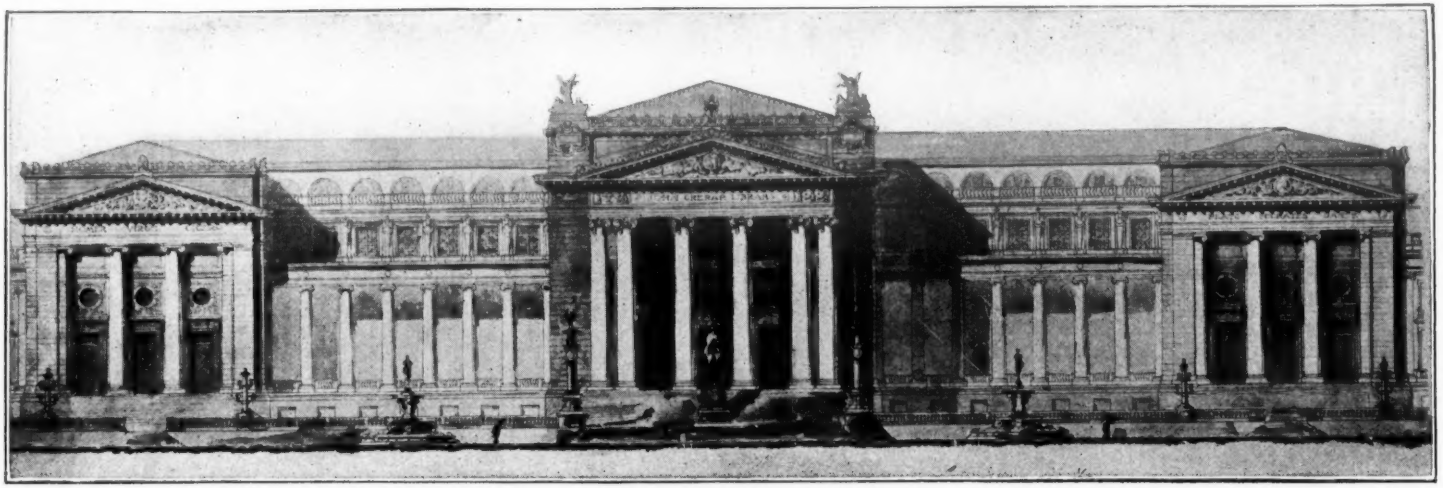
ALL over the world there is, at this period, an astounding and unparalleled movement of people toward cities. The tendency of people to gather in close contact has always existed, but today is operating more strongly than ever in the history of man. Naturally this movement is creating new problems in municipal government. It is bringing up new tasks in social science, or the science of maintaining health and good order among people of different families and different races when brought closely in contact.

In the past the problem confronting the people of the cities was to provide gas, electric light, pure water, adequate schools and properly equipped public institutions for the sick and improvident. Today the problem in great cities is to provide light, air, ample means for healthful recreation, relief from congestion, facilitation of traffic, housing of the poor, scientific organization of charities, better public improvements and attractive surroundings for the multitudes swarming to the cities.

The great issue confronting American municipalities today is right citizenship in relation to City Planning. Right city planning is basic. A proper city plan, officially adopted and realized, for the direction of the growth of a city in an orderly and systematic way, practically affords a solution of the problem confronting our constantly expanding municipalities.

European cities have a distinct advantage over American cities in city planning. In Germany, France and England, where vast city planning projects are being carried out, the advantage lies in the fact that the work originates with the municipality and is usually aided financially by the government, and its direction, to some extent, is under government supervision. In American cities the reverse is true. Here city planning orginates, as in the case of the Chicago Plan, with a small group of public-spirited citizens. Then follows a long and arduous campaign of education with the people to arouse civic interest in the city's welfare. When that is accomplished, usually an expression in the form of a popular demand follows. Plans are then submitted to city authorities, and the long and tedious process of administrative machiner, necessitated by legal procedure, ensues, and finally something tangible is accomplished. Achievements are made only in proportion as the people have gained knowledge of city interests.

Citizenship all right—the city will be all right. The cities all right—the nation will be all right, for our cities today control our country. The old order—national control by rural influence—has passed. The conservation of natural resources as a national asset of prime importance, is occupying the serious attention of the government, but what is more important than the conservation of public health in our large cities? Every human life is a national asset and should be carefully preserved.



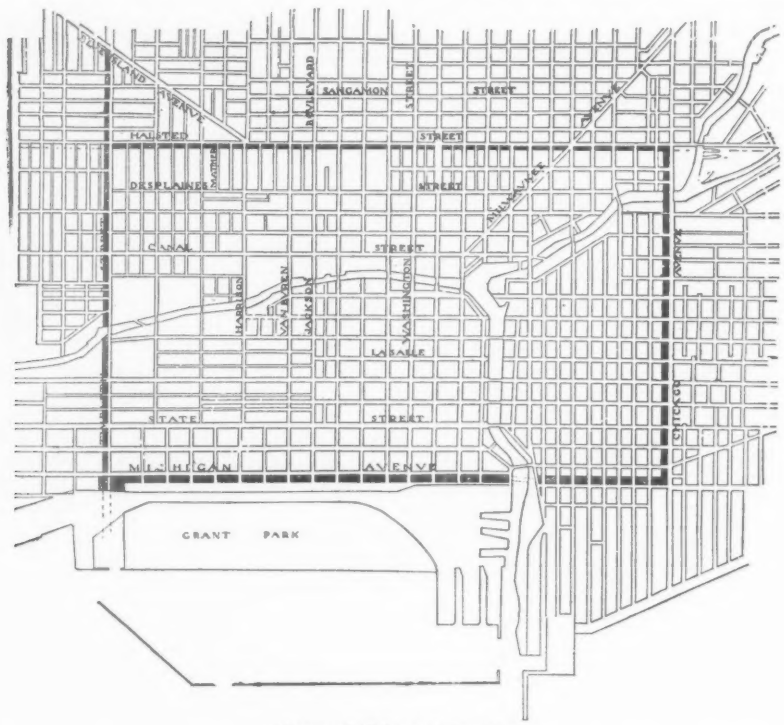
THE CHICAGO PLAN.

Front Elevation of the Proposed John Crerar Library Building, Chicago. This Structure Is to Be Erected in Grant Park. The Late John Crerar Endowed the Library. The Trustees Have a Building Fund of $1,000,000.

THE CHICAGO PLAN.

Field Museum of Natural History, Chicago. This Structure Is to Be Erected in Grant Park at a Cost of $4,000,000, Provided in the Will of Marshall Field.

Forty-three per cent. of the people of the United States now live in cities. Twelve per cent. live in three cities alone, Chicago, New York, and Philadelphia. It is a matter of government record, in countries where conscription to army service is compulsory, that the physique of the city dweller is degenerating. Only a relatively small percentage in congested cities are able to measure up to the strict requirements for military service. Germany is alarmed on account of this condition, and has undertaken a wide movement intelligently and systematically to direct proper city plans for bettering present city conditions, and for future growth.* England, during the Boer War, and the United States, during the Spanish-American War, found the conditions described existing to a very alarming extent.




THE CHICAGO PLAN.

Plan of the Quadrangle. Bounded by Twelfth Street on the South, Halstead Street on the West, Chicago Avenue on the North and Michigan Avenue on the East. It is the Purpose of the Commission to Complete This Square as the First Great Necessary Step in Carrying Out the Plan.

The city of Chicago has been quick to appreciate the necessities arising from modern day municipal problems—which the experience of European cities has proven can be solved only thro the adoption and realization of an official plan designed to direct the future growth of the city in an orderly and systematic way. Such is the Chicago Plan which the city has placed in the hands of the Chicago Plan Commission for study and execution. The Plan in its inception gained nation-wide prominence as the "Chicago Beautiful" plan. It has since become internationally known as the Plan of Chicago. A more appropriate title than Chicago Beautiful is Chicago Practical, since the Plan deals directly with the three greatest problems confronting every metropolitan community—relief of congestion, facilitation of traffic and the conservation of public health.

The origin of the Chicago Plan dates back to the World's Columbian Exposition in 1893. A few of Chicago's leading men, who were members of the Commercial Club of Chicago, and directors of the exposition, perceiving the splendid and convenient arrangement of the streets, the practical grouping of the buildings, and the general beautification and magnifi-

*Dr. Grimshaw's article on page 161 of this issue explains the city planning situation in Germany.

cence of the entire scheme, decided that if some of the more practical and main essentials of the plan of the exposition could be embodied in a plan for Chicago, the undertaking would be worthy of their efforts and fraught with the greatest possible significance to the city.

At almost the same time the Merchants' Club of Chicago became interested, and work on a plan was formally undertaken by this club in 1903, and was well under way when that club was merged with the Commercial Club in 1907, under the name of the latter. In producing the Plan of Chicago the Commercial Club spared neither time, money nor effort. Daniel H. Burnham, world-renowned architect and city planner, took charge of the details of the plan, and gave his genius to the task without charge. The World's Fair—the work of Daniel H. Burnham—was designed upon Athenian lines. So also was the great Haussmann plan for the rebuilding of the city of Paris. The people of Athens were the greatest city planners of any time. Athenian lines of architecture and grouping of buildings and arrangement of streets have since been made the basis of every city plan of any magnitude. Pericles found Athens a city of mud and left it a city of marble. In 1908 the charts, maps and drawings necessary for carrying out the plans were completed, and these, together with subject-matter

THE CHICAGO PLAN.
Proposed Boulevard to Connect the North and South Sides of the River. Looking North from Washington Street. (Painting by Jules Guerin.)

relating thereto, were arranged in a magnificent volume published by the Commercial Club.

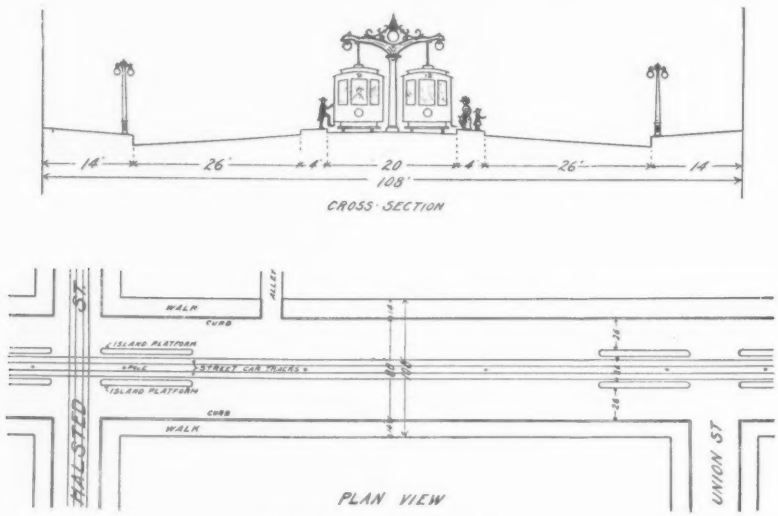
Thus, after years of study and hard work by the Commercial Club members, the plan was completed and ready for submission to the citizens in the early fall of 1909. Then it was evident to the leaders of the movement that the time had come to engage the interests of the public and to put the plan into the hands of the representatives of the people. After conferring with the city authorities, it was decided to create a permanent organization to be known as the Chicago Plan Commission. This body, it was decided, should be composed of a large number of men of influence to be representatives of the business and social interests of the city.

On July 6, 1909, the Hon. Fred A. Busse, (mayor of Chicago,) sent a message to the city council requesting authority to appoint this commission, which authority the council granted. On November 1, 1909, the Mayor sent a second message to the city council announcing the appointment of three hundred twenty-eight citizens of Chicago as members of the Chicago Plan Commission. To secure at all times adequate representation on the Chicago Plan Commission of the city government and all other locally interested governmental agencies, it was decreed that members of the city council, the corporation counsel, commissioner of public works, city engineer, health commissioner, and the presidents of the following boards—education, library, park boards and sanitary district—should be ex-officio members of the Commission, and that the membership of persons appointed because of official position should cease when they retired from office, the membership to be assumed by their successors.

The central idea out of which the Chicago Plan has grown is: If Chicago is to become, as we believe, the greatest and most attractive city of this continent, its development and improvement should be guided along certain definite and pre-arrange lines, to the end that the necessary expenditures for public improvements from year to year may serve not only the purpose of the moment, but also the needs of the future.

The Chicago Plan is not a scheme for spending untold millions of dollars, now or in the future. On the contrary, it is a comprehensive suggestion of what may be accomplished in the course of years by spending, in conformity with a well-defined plan, the money which must be spent from time to time on permanent public improvements. The Chicago Plan is in conflict with no other plan or project for the industrial or commercial development of Chicago.

Looking west from the lake front, the city, when developed in accordance with the Chicago Plan, will present wonderful harmony of detail—continuity of design typifying scientific arrangement. It will be seen from this brief description that the Chicago Plan will direct the fu-




THE CHICAGO PLAN.

Plan of the New Twelfth Street. Plan Below Shows "Islands" on Both Sides of the Car Track for Safety in Entering and Leaving Street Cars.

VIEW FROM THE MICHIGAN AVENUE APPROACH

VIEW FROM THE LAKE MICHIGAN SIDE

THE CHICAGO PLAN.
Field Museum as Shown in the Model of Grant Park, Chicago.

ture growth of the city in a systematic and orderly way, and it has to do primarily with the relief of congestion, the facilitation of traffic and the safety and preservation of the public health of our citizens. In the interests of the latter, the Plan demands more and larger parks and playgrounds, and better and wider streets.

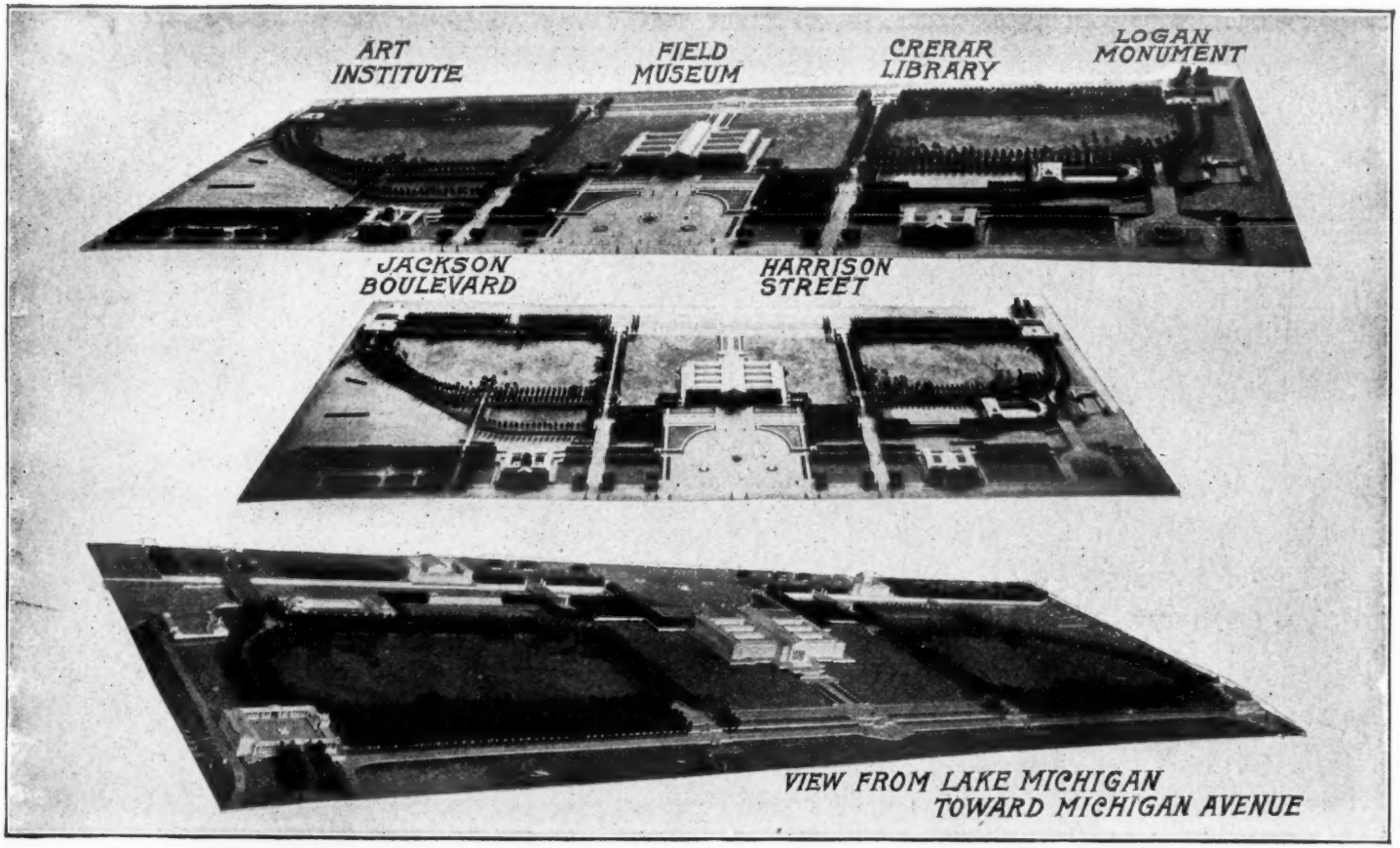
The Commission has delivered lectures on the Chicago Plan illustrated with stereopticon views, in every part of the city of Chicago, to a variety of audiences, all of which were highly interested in, and in sympathy with the plans of the Commission. The Commission compiled and distributed 165,000 copies of a booklet entitled "Chicago's Greatest Issue—an Official Plan," intended to popularize the Chicago Plan and to familiarize all our citizens with its provisions and the necessity for its adoption. The Commission also prepared a text-book entitled "Wacker's Manual of the Plan of Chicago," which was adopted as a regularly accredited study in the eighth grade of the Chicago public schools. Fifteen thousand copies were distributed to the school children, in the belief that right citienship in relation to city planning is one of the greatest issues confronting any growing American municipality today. The book is intended to accomplish two objects—first drawing the sympathy of the parents to the Plan, and, second and greater, the training of our future citizens to become responsible heads of government control.

Initial attention has been devoted to the three major phases of the Chicago Plan, all of which are in a fair way to early realization. The first step taken was the widening of West Twelfth street, one section of the quadrangle which it is proposed to establish surrounding the heart of the city, to provide free and easy access between the various sections of the city without the necessity of traffic going thro the congested downtown section. This widening case has made most satisfactory progress. An ordinance was passed on July 23, appropriating $1,750,000 to pay the city's share of this work. It is expected condemnation proceedings for property to be taken will be commenced in the near future. Another section of the quadrangle, and the street which is destined to bear the heaviest traffic of any street in the world, is Michigan Avenue. This is to be widened and projected a mile north, to form a boulevard connection between the North and South sides of the city, on a two-level plan, to allow the free circulation of east and west traffic underneath the boulevard level, without interfering with north and south traffic.

Next to convenience and orderliness in its street arrangements, the most essential thing in a great city is a park area

THE CHICAGO PLAN.

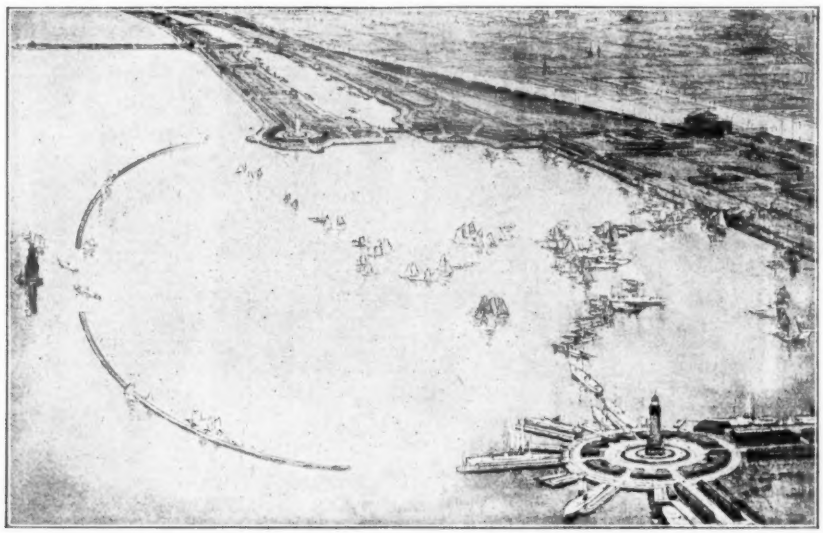
Looking North of the South Branch of the Chicago River. Showing the Suggested Arrangement of Streets and Ways for Teaming and Reception of Freight at Different Levels. (Painting by Jules Guerin.)




THE CHICAGO PLAN.
Model of Grant Park, Chicago, Used as a Basis of Study.

THE CHICAGO PLAN.
Additional Views of the Model of Grant Park, Chicago.

sufficient for the preservation of the public health of the citizens. Parks of a city have been aptly compared with the lungs of a person, as means by which the city and its people get the stimulus of fresh air so necessary to normal well-being. Three great elements make up the park plans of the future city under the Chicago Plan. First, there is the lake front to be improved, beautified and put at the service of the city's thousands for the creation and preservation of public health. Second, there is provision to be made for extending the park areas within the city, that wholesome and necessary recreation may be close at hand for all the people in all parts of the great future city.



THE CHICAGO PLAN.
Birdseye View of Grant Park, Chicago. The Harbor and the Lagoons of the Proposed Park on the South Shore. (Painting by Jules Guerin.)

Third, there are the wide areas of forest and stream outside of the corporate limits, but upon the borders of the city, to be acquired and held in their natural state as places where the city-worn worker and his family may rest and wander freely in holiday and vacation time.

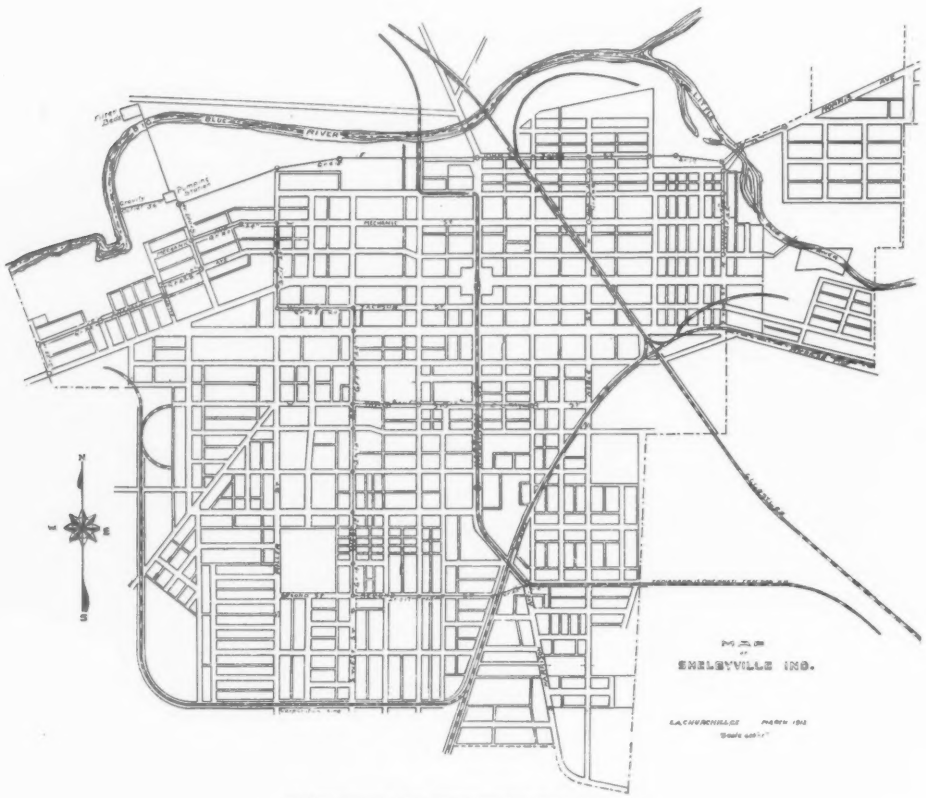
First attention has been given to the lake front, which forms at once one of the greatest and spectacular features of the plan and one easiest to be carried out. Grant Park, at the very heart of the city on the lake front, has been created out of the lake shore built up of the city's waste material and refuse. The area of this park is over two hundred acres, and it is proposed to create, by the same method, a shore line park extending five miles along the water's edge south to Jackson Park. There are annually over four million cubic yards of waste and excavated material produced in Chicago. This amount would create over one hundred acres a year—without any expense to the taxpayers of the city—and would add over 1,500 acres to the park system of Chicago. Under the plan, there would be created an island park and boulevard paralleling the shore line park the entire distance, with a lagoon between, always calm and safe, for rowing, sailing, motorboating and swimming. When this park has been completed, Chicago will have the most magnificent waterfront in the world, with a continuous shore line of parks approximately twelve miles in length, the inner park 300 feet wide. the outer park half a mile wide, and the lagoon between the two, 700 feet wide. The Chicago Plan also contemplates carrying similar park developments north along the shore for about eight miles.

Great dangers to mankind lurk in the existence of cities. City life is intense, many times more wearing upon the nerves than that of the country. It is this strain of city life which increases insanity and brings weaknesses of many kinds to shorten life and deprive the people of their vigor. These ills may best be coped with by the realization of a proper plan to direct the growth and development of a city along scientific lines, such as is provided in the Plan of Chicago.

# SEWERAGE OF SHELBYVILLE, IND.

SHELBYVILLE, Ind., is a city of about 10,000 population, located within a bend of the Big Blue river in the eastern part of Indiana. By reason of its location, topography and the character of the soils encountered, the construction of the sewers contains many interesting features.

Plans for the sewers were prepared in 1908, and the main trunk lines laid out were substantially as shown in the accompanying plan. A great many difficulties were experienced in laying the grades on account of the topographical features of the city. The elevation of the outlets is 93, and a rather abrupt rise brings the ground level at Miller and Mechanic streets to 108. Then continuing on south along the line of the "South Branch A," as that extension on West street was called, the ground level becomes 116 at Jackson street and then drops away to 111 at the point where the line turns east on Second street. Thus, even tho the outlet is taken far below highwater mark, a minimum grade is obtained only at the expense of what proved to be a 22-foot cut at the summit of the bill in the vicinity of Jackson and West streets. As completed, the sewer is fully effective only during low or mean water level at the river. A slight rise of the river sends water back along the sewers for a distance of from 1,000 to 1,600 feet from the outlet,




SHELBYVILLE SEWERAGE SYSTEM.
City Map Showing Trunk Lines Constructed.

and the manholes, which on the "River Branch A" are brought high above the level of the ground, contain from six to eight feet of water, and at times during floods water has forced out thru the manholes all along this line. The pumping station, the location of which is shown on the map, will be constructed in the near future, and at that time the sewers will become effective under all conditions.

At present the sewers drain into a receiving well, whence the sewage drains

by gravity, as the water level permits, into the river. A check valve, operated under supervision of the street superintendent, is provided as a protection against excessive back flow. The sewage disposal plant, the location of which is indicated by the "filter beds" on the map, will probably not be constructed until such time as the state shall legislate against the emptying of raw sewage into its streams.

The sewer presented many construction difficulties, which, however, were surmounted by the contractors, and the completed pipe lines are true to grade and as tight at the joints as it is possible to make them. One contracting firm took the entire contract, including about 22,000 feet of pipe sewers, ranging from 12 to 30 inches in size, with all manholes and appurtenances. Whether from a mistaken estimate or natural difficulties, this contractor was obliged to give up the contract after completing only a portion of the "River Branch" and a small portion of another branch. This contractor was paid about $37,000 for that portion which he had completed, and was released. The Julius Keller Construction Company, of Indianapolis, then undertook and completed the remaining portion, about 14,000 feet of 20-inch to 12-inch sewers, at a price of $45,794.

The greater portion of the sewer was laid in gravel which, tho it provided easy digging, yet required sheeting for practically the entire distance. The worst trouble was caused by water which, along practically the entire job, filtered in thru the gravel so fast as to rise three or four feet into the trench during a night. The first portion of the work was laid with a jointing compound which required that water should be excluded from the joint before it was poured, otherwise the material "sputtered" and was thrown out of the joint like hot lead under similar conditions. The pumping cost about $25 a day. This made necessary the continuous use of two 37,000-gal.-per-hour pumps and the digging of "sump holes" on both sides of the pipe joint, in order that the water might be entirely drained off.

SHELBYVILLE SEWERAGE SYSTEM.
Pouring Patent Joints on the Bank.

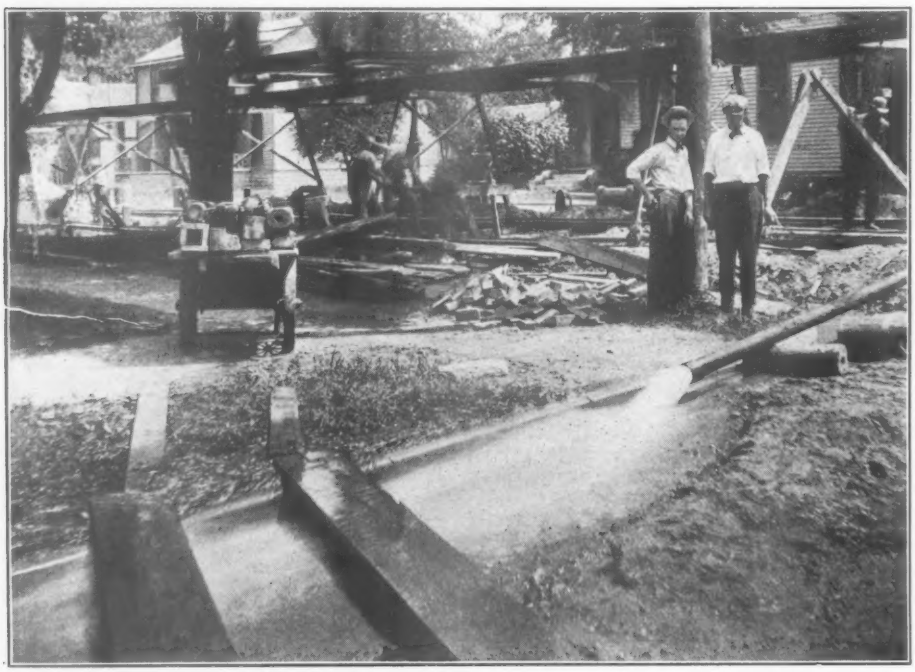
After the work was about one-half completed, permission was secured from the city authorities, and G-K compound, a jointing material which could be poured in water, was substituted. From that time the pumps were used only occasionally as an excessive depth of water in the trench demanded. The remaining portion of the first mentioned compound was used up in joints poured on the bank. One interesting example of the tightness and elasticity of the second compound is shown by an incident which occurred

when laying the 20-inch pipe. About 70 feet had been laid in the morning with one end in a bulkhead where a manhole was to be located, and the other end was held down by the back fill on the preceding section. Water and sand entered the open trench and raised the 70-foot section so that it was 12 to 15 inches above grade at the center. At this time the situation was discovered by the contractor. A jack placed at the highest point and working against a timber placed across the trench above failed to cause the pipe to go back into place. The water was pumped out, and after the sand had been removed from beneath the line, the jack forced the whole line back to grade. After this a pressure test showed the joints to be tight, tho they had been forced to bend in two directions, when the pipe was raised and when it was returned to grade.

One section of extremely difficult construction was a short stretch of gravel underlaid by quicksand. The cut along this portion was about 22 feet, and of this about 8 feet was quicksand. The water which bubbled up thru this quicksand bed caused it to "work and move" as if it were alive. Sheeting was driven to about three feet below the bottom line of the tile, and the sand was removed. Piling was then driven in on both sides at intervals and "saddles" were placed across, upon which pipes were laid. Concrete was then placed around, under and above the pipes to anchor them in place, and the sheeting was left when the trench was back filled. Only about 380 feet of 20-inch pipe line was constructed during the month in which this quicksand was encountered as compared to 1,500 to 2,000 feet under favorable conditions.

Another interesting condition was encountered where the extension of the "River Branch A" crosses the river. It was necessary to construct an inverted siphon, using about 120 feet of 12-inch cast iron pipe, which was laid 5 to 6 feet deep under the river. In making this crossing, a dam was constructed across one-half of the stream and a "sump hole" was dug, into which the water was drained and pumped out. The trench was thus left perfectly dry while the pipe was laid and jointed. The same procedure was then repeated with a dam across the other half of the stream.

The straight ditch was cut, principally by means of ditching machines. The Moore machine and the Parsons machine were both used on the work. The former is a simple trestle and trackway, along which the dirt is removed to make the back fill. The Parsons machine is a chain



SHELBYVILLE SEWERAGE SYSTEM.
Showing Flow of Water from Sewer Trench.

and bucket device capable of digging a trench as deep as 20 feet and up to 5 feet in width. It has a cross belt conveyor attachment which empties the earth on a longitudinal belt conveyor which carries it back into the trench at about 50 feet distance from the digging. Except for a short stretch of hard-pan where dynamite was used, not even picks were required to loosen the soil.

The tile were joined two together on the bank, as shown in the photograph. They were then lifted by means of a tripod and tackle and swung into place in the trench.

The plans for the sewer were prepared by Riggs & Sherman, of Toledo, Ohio, with J. H. Phillipi, of Shelbyville, city engineer. Some modifications were made by Charles C. Brown, of Indianapolis, before the second letting of the contract. The work was completed under W. H. Isley, city engineer. L. A. Churchill was superintendent in charge of the work.

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# THE COVERING OF JONES' FALLS, BALTIMORE, MD.

By Stuart Stevens Scott.

ONE of the most far-reaching and best paying improvements the city of Baltimore will ever undertake is the work of inclosing Jones' Falls in reinforced concrete conduits and building a roadway over them. What has for more than a century been a nuisance, an expense and an eyesore thro the heart of the city, will not only be removed, but the city will have reclaimed a strip of land 75 feet wide and more than a mile long which will become a broad, smooth roadway affording a much-needed relief in a North and South thoroughfare connecting the docks and the business section of the city with the railroad depots in the Northern section. This roadway will be on an easy grade, enabling one horsee to accomplish what now requires two, thus effecting a great saving in money and time to merchants.

The improvement will transform back lots abutting an open stream into valuable land facing a broad boulevard. It will not only improve the property to the extent of securing for the city sufficient revenue from increased taxes to pay the interest on the bonds and create a sinking fund to redeem the loan, but it will eliminate the dozen expensive bridges and do away with the annual appropriation for bridge repair, which runs into thousands of dollars.

Aside from the esthetic features, and to say nothing of having an open sewer inclosed, the most important part will be the prevention of the flooding of property along the low-lying sections of the stream. Jones' Falls, altho normally a somewhat sluggish stream, is, when accentuated by heavy rains, very turbulent, and has caused much damage by overflowing. The most notable instances were on July 24, 1868, and July 5, 1904. In 1868 the flood not only did damage to the extent of several hundred thousand dollars, but caused the loss of a number of lives. In 1904 the damage was confined to property, altho many persons had narrow escapes.

Following this last flood, and with the construction of the new sewerage and storm water drainage system, changes were made which have since kept the stream within its bounds, altho there have been numerous periods of excessive rainfall.

Notwithstanding the general belief that the Falls would never again leave its banks, the city authorities deemed it expedient to close the stream and thus make it absolutely safe.

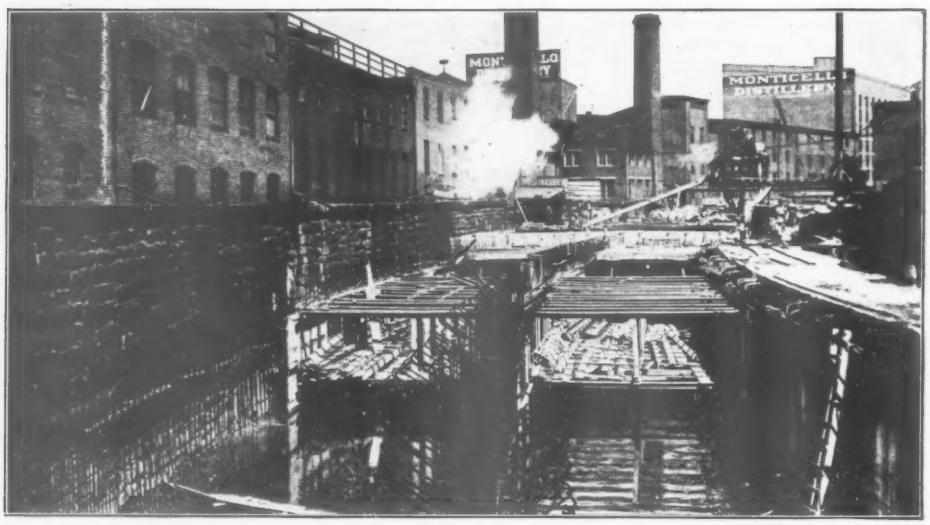
From an economical point of view, the city could not have taken a better step. About thirty years ago, the city spent more than $1,000,000 upon retaining walls, and since that period has spent fully another million in building and maintaining bridges. The inclosing of the Falls and the construction of the roadway will cost approximately $1,300,000, and it has been estimated that the revenue from the increased taxation of property in the vicinity will pay back every cent of this expenditure.

The total length of the sewer is 1,764 feet. It begins at the northern edge of the city, with a basin approach a little more than 100 feet long, from which point the water flows into a tunnel 28 feet by 29 feet, 1,080 feet long, to a junction chamber where begins a series of three ducts, the east duct being 8 feet by 14½ feet, and the others each 17 feet by 17 feet. These ducts lead 1,400 feet to where the east duct is enlarged to 15½ feet by 16 feet and the others to 15½ feet by 20 feet each.

At a point 1,300 feet farther down stream the east duct is enlarged to 18½ feet by 15 feet and the others each to 20 feet by 15½ feet. Thence these sizes are carried 2,800 feet to the outlet apron in the harbor.

The object in having the east duct

COVERING JONES FALLS.
The Start of the Work, Constructing Cofferdams.



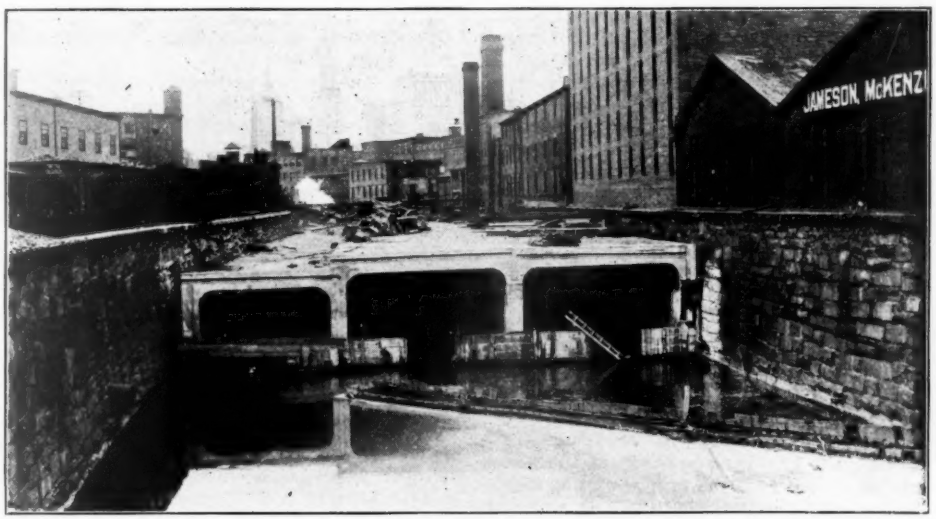
COVERING JONES FALLS.
Showing Side Reinforcement and Centering in Place.

smaller, is to use it for the ordinary discharge of the stream and to keep the water so closely confined that it will rush thro with a force sufficient to prevent sediment and to keep the duct clean. As the water increases in volume in the junction chamber and overcrowds the east duct, it finds its way into the central duct. Should even this duct be overcrowded, there is the third one, and it is believed that these three ducts will take care of even the worst storms.

Altho not as spectacular as many other engineering feats, the covering of the Falls is no child's play, and the contractors have had their hands full all the time. All of the work has had to be done by constructing coffer dams, but even tho these dams have been high and steam pumps have been employed, the Falls has contested every inch. During the winter and this spring the contractors have had innumerable delays because of high water, and on several occasions much of their timber has been washd down stream.

For convenience, and with the idea of better controlling the stream, the east duct was built first, and after it had been carried down stream several hundred feet work on the other ducts began, all of the water being sent thro the east duct. This method has been pursued as much as possible, altho, at certain points, it was necessary to shift the stream from one side to the other. That there is but 75 feet of space in which to work and that it is necessary to have dry bottom to lay the bottoms of the ducts has greatly hampered the contractors.

While the granite retaining walls of the stream are solid the ducts are being built independent, with the retaining walls more as frames than as supports. The side walls of the ducts are each 2 feet thick and the top varies from 27 inches to 35 inches. Reinforcing is liberally used, the steel being in square bars and varying from ¼ inch to 1¼ inch. In the walls the vertical bars are ⅝ inch, spaced 7¾ inches, while the longitudinal bars are ¼ inch, spaced 2 feet to 3 feet. The bars in the top are 1¼ inch, spaced 7¾ inches, and there are also ¼ inch longitudinal bars, spaced 2 feet. The bars in the bottom are ¾ inch, spaced 15½ inches, and the longitudinal bars are ½ inch, spaced 12 inches.




COVERING JONES FALLS.
Head of Completed Portion, Showing the Ducts.

The east duct has a brick invert, one brick deep, but the bottoms of the other ducts are of concrete.

The construction of the conduits is being carried on by the Elkan-Tuft Construction Co. and by Fisher & Carozza. The contract for section No. 1 was awarded to the first named contractor for $503,990, and Section No. 2 to the other contractor for $703,989.50. The contract for the construction of the first section of paving has been awarded to the David M. Andrew Contracting Co. This contract covers about 13,000 square yards of pavement, or approximately one-fourth of the total amount to be laid. The pavement will be of granite blocks throughout and will be 50 feet wide between curbs. There will be 12½ feet concrete sidewalks on both sides. It is expected that the entire work will be completed by January, 1913.

# PRACTICAL ROAD BUILDING.*

By John N. Edy, Jun. Am. Soc. C. E., Assistant City Engineer, Billings, Mont.

## BRIDGES.

IN selecting a location and span for a bridge, the drainage area is not alone to be considered. It is absolutely essential that a substantial foundation for the piers and abutments be secured. The banks should be well defined and the channel straight. While it is not always possible to find an ideal site for a bridge, a good location should be secured as local conditions fix the span. High-water marks are to be observed, so that the lowest point of the span may be high enough to clear all drift. This caution applies to all bridges. In the following paragraphs spans of 10 feet and over will be designated as bridges, spans of less than 10 feet being considered culverts, having been treated in the preceding paragraphs. For short spans, say up to 50 feet, reinforced concrete is now being used to a great extent; steel bridges on stone or concrete abutments are most common, while timber is being used less each year for this purpose.

### PRELIMINARY.

The following points should be noted in choosing a site and preparing for the construction of a highway bridge:

1. If the road as established does not approach what appears to be a good bridge site, consider the advisability of changing the location of the road.

2. Note the direction of stream flow, observing the general condition of the water course, and if there is any apparent likelihood of the channel changing or washing out piers or abutments.

3. Ascertain the nature of the material composing the stream bed; also the foundation material in the banks, whether hard or soft, or of sand, clay or gravel or rock. If possible, ascertain the depth to solid rock.

4. Get a cross-section of the stream at the proposed crossing, noting low and high-water marks, and mean stage of water.

5. Ascertain the causes of high water, and if there is likelihood of log or ice gorge.

6. Note particularly the channel at the proposed site, observing the condition of the banks, whether high and steep, sloping or flat.

7. Note if provision must be made for a cattle or wagon pass under the bridge or approach.

8. If piles are to be used, see if they can be obtained in the vicinity.

9. In case earth fill approaches are to be built, state if the material for the fill can be had on the road right-of-way, or if borrow pits must be opened on adjacent land. From the height and width of approaches ascertain if present width of road right-of-way is sufficient.

10. Ascertain the location of, and carefully examine, deposits of stone, sand and gravel that may be used in the construction of stone or concrete abutments, etc.

11. State whether the stream is ever "dry," and if so, during what months.

12. Select location for storing piling, stone, gravel, steel and cement.

13. If the proposed structure involves the purchase of land, note carefully and report on conditions.

14. Inquire as to accommodations for boarding and lodging; also advise how the men may get to and from work.

15. Note the volume and nature of traffic, and advise as to the possibility of diverting same during construction. (This applies especially to renewals.)

16. Advise whether rip-rapping or other bank protection is necessary.

17. Advise if bridge will cross the stream at right angle, and if not, why, and give angle of skew.

18. Ascertain the location and probable cost of piles and lumber.

19. Note the condition of the road between the bridge site and nearest shipping point with reference to the maximum load that can be hauled. Advise if road is ever in an impassable condition.

20. Ascertain the wages paid in the vicinity for labor and teams.

21. Note carefully the labor conditions in the vicinity.

22. Advise as to the best season of the year to build the bridge.

2v. Ascertain if local contractor has pile-driving plant in the vicinity, and if can be obtained, inquire charge for same.

24. Examine several possible sites for the bridge in an effort to locate the most desirable crossing, regardless of the location of the road leading to the stream. Report fully on this matter.

25. Take elevations for a distance of at least 500 feet on each side of the stream, and leave a permanent B. M. on each side.

26. State alignment of road approaching the stream.

27. Note all sloughs and creeks in the vicinity and ascertain their effect on the stream in times of high water.

28. Investigate other bridges crossing the same stream, and determine whether extraordinary conditions will attend the construction of the proposed bridge.

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29. Remember that earth approaches are better than timber trestles; also that the bridge is being placed for the accommodation of future, as well as present, conditions of traffic.

Each bridge is a problem in itself; and while the commissioner and supervisor are not required to build them, they have to buy them, so that the following suggestions are pertinent:

Do not advertise for bridge bids, permitting each contractor to bid on his own design. Have the bridge designed by a competent bridge engineer (the State Highway Commission, if there is one in the State) and receive bids on this one plan. Inasmuch as very heavy traction engines and road rollers are being placed on the market, provision must be made for their safe transportation, and all bridges and culverts should be safer under a live load of at least 15 tons. Do not permit the use of wooden joist in the floor system of a steel bridge. Steel beams should be used for this purpose; they do not cost a great deal more than timber stringers, and they make the bridge more safe and permanent.

The bridge should rest on abutments of stone or concrete. The top of the abutment should never be less than 2 feet 6 inches, the bottom width being not less than one-fourth the height. In all cases abutments and piers must extend below the bed of the stream. Steel tubes filled with concrete form a very satisfactory substructure, if correctly designed and placed. Tubes should be filled with a good quality of concrete mixed in the proportions 1:2½:5.

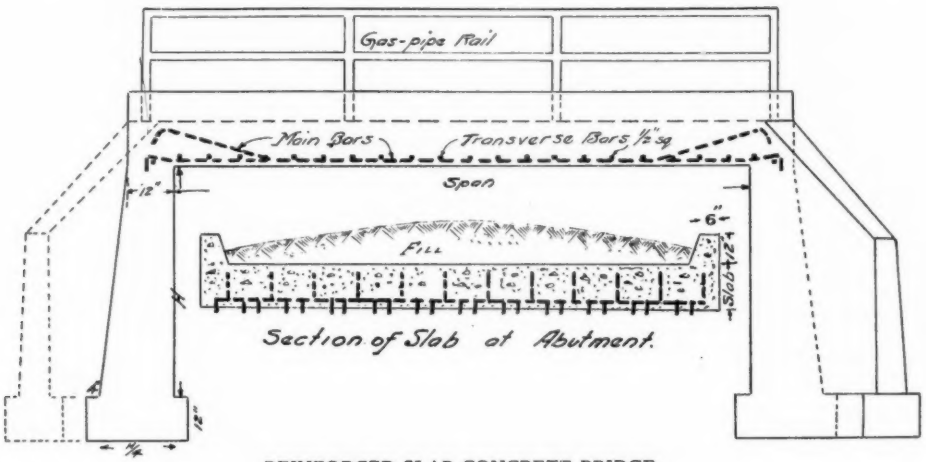
CONSTRUCTION.

During construction engage an inspector who will see that the plans and specifications are fulfilled. All material and dimensions should be inspected on the ground, and if not in conformity with the plans, should be rejected. Particular attention must be given the riveting and bolting, to see that no rivets or bolts are omitted; and to the concrete, to see that it is properly mixed and placed.

Concrete floors are preferable to plank for the same reason that permanent culverts are preferable to flimsy wooden boxes; and while a concrete floor increases the dead weight on the bridge, it also better distributes the live load.

SHORT SPAN BRIDGES:

By far the greater number of bridges with which the supervisor has to contend are those of short span, say 50 feet and under. There are always small creeks, sloughs, ditches, etc., that must be bridged in this manner. Furthermore, it is often possible to use a number of short spans in place of one long one. This is true in crossing streams of no appreciable current, as in the case of wide "dry creeks," sloughs, etc. These small bridges can often be erected by the supervisor with local labor. The writer has found that the men usually take an active interest in this work, feeling that they are performing a valuable service for the community.




REINFORCED SLAB CONCRETE BRIDGE.

Plain concrete may be substituted for stone in any structure. Reinforced concrete is the accepted material for permanent spans under 50 feet. For spans less than 20 feet such bridges are built as a flat slab resting on concrete abutments. The accompanying sketch shows the design of reinforced concrete slab bridges, which are readily erected. The form work is simple, and the whole structure, excepting perhaps the steel, may be built of local material. It will be observed that

TABLE OF REINFORCED CONCRETE SLABS.

SQUARE BAR REINFORCEMENT

| Clear Span | Depth of Slab | Main Bars Size | Main Bars Length | Main Bars Space | Transverse Bars Size | Transverse Bars Length | Transverse Bars Space |
|---|---|---|---|---|---|---|---|
| **Culvert Roadway 20 Feet Wide.** | | | | | | | |
| 2 ft. | 5 in. | ½ in. | 3 ft. | 6 in. | ½ in. | 20½ ft. | 12 in. |
| 3 ft. | 6 in. | ½ in. | 4 ft. | 5½ in. | ½ in. | 20½ ft. | 12 in. |
| 4 ft. | 6½ in. | ⅝ in. | 5 ft. | 7 in. | ½ in. | 20½ ft. | 12 in. |
| 5 ft. | 7½ in. | ⅝ in. | 6 ft. | 6½ in. | ½ in. | 20½ ft. | 12 in. |
| 6 ft. | 8 in. | ⅝ in. | 7 ft. | 6 in. | ½ in. | 20½ ft. | 12 in. |
| 7 ft. | 9 in. | ⅝ in. | 8 ft. | 5½ in. | ½ in. | 20½ ft. | 12 in. |
| 8 ft. | 9½ ft. | ¾ in. | 9 ft. | 7 in. | ½ in. | 20½ ft. | 12 in |
| **Bridge Roadway 16 Feet Wide.** | | | | | | | |
| 10 ft. | 11 in. | ¾ in. | 12 ft. | 6 in. | ½ in. | 17 ft. | 12 in. |
| 12 ft. | 12 in. | ⅞ in. | 14 ft. | 7 in. | ½ in. | 17 ft. | 12 in. |
| 14 ft. | 13 in. | ⅞ in. | 16 ft. | 6½ in. | ½ in. | 17 ft. | 12 in. |
| 16 ft. | 15 in. | ⅞ in. | 18 ft. | 6 in. | ½ in. | 17 ft. | 12 in. |
| 18 ft. | 16 in. | ⅞ in. | 20 ft. | 5½ in. | ½ in. | 17 ft. | 12 in. |
| 20 ft. | 17 in. | 1 in. | 22 ft. | 6½ in. | ½ in. | 17 ft. | 12 in. |

either bars or expanded metal may be used for reinforcement, the bars being preferable on the longer spans, inasmuch as they may be bent up to provide for diagonal tension.

The concrete must be placed with care so as not to disturb the reinforcement. The strength of any reinforced concrete bridge depends upon the position of the steel, which must be placed in the bottom of the slab, as shown. A rail of pipe or concrete may be used on such a bridge, as desired. Very rarely do these bridges cost more than if built entirely of steel on the same abutments. Whenever a fill is to be placed against the ends of a structure, as is usually the case, the abutment must serve as a permanent retaining wall. It is for this reason that the bottom width should never be less than one-fourth the height. Concrete for bridge construction should be rich, and the forms left in place for one to two weeks, as previously noted; the forms and false work supporting the bottom of the slab to be left for a longer time. No reinforced concrete bridge work should be started so late in the fall that there is danger of freezing weather before completion. While the designs given above are in accordance with good practice, the inexperienced supervisor is cautioned not to undertake the building of so important a structure without engi neering advice as to the particular condi tions.

## MINOR PROBLEMS OF TARRED ROADS.

By Francis G. Wickware, New York City.

THE first decade of surface tarring for the suppression of dust on macadam roads ends with the treatment formally admitted to the list of practical processes by the International Road Congress. First applied on a practical scale in 1901, the process very soon attained to wide popularity, and in recent years its extension has been remarkable in both distribution and degree. The complete demonstration of the efficiency of tar treatment as a dust preventive followed close upon the earliest experiments; it remained for prolonged trial to prove an economy comparable with that of competitive processes. The experience of the last few years has established beyond question that under all conditions tarring diminishes wear, increases drurability, and reduces the cost of road cleaning. Whether these economies are sufficient to offset the admittedly high cost of the process, depends, in any case, on the nature and frequency of the traffic the tarred road is called upon to bear. The reputation of tar treatment has suffered, to a certain extent, from the dissatisfaction of municipalities who have demanded of tarred macadam roads a service which could be successfully performed only by some type of permanent pavement; but when applied with judgment and care, in localities where the traffic conditions guarantee a fair degree of permanence to macadam roads, it is the almost universal experience of highway engineers that surface tarring is an efficient and economical process, and, except under very unusual conditions, the best available solution of the problem of adapting ordinary highways to motor-vehicle traffic.

Like all other processes, however, tar treatment is not wholly free from de-

fects. Tarred roads are accused of an injurious effect on the eyes of users, and of a pernicious influence on neighboring vegetation. Compared with the positive merits of surface tarring, its inconveniences are of minor importance; but the extent of the literature in which the defects of the process are canvassed, to which not only highway experts but also physicians, chemists, physicists, and horticulturists of considerable eminence have contributed, indicates that they are by no means without significance.

Eye troubles first made their appearance in France in 1906, among drivers of automobiles on the Sarthe circuit, which had been freshly tarred for almost the whole of its length. The fact that ocular injuries had been observed, was frankly communicated to the first International Road Congress, held at Paris in 1908, by Dr. Guglielminetti, whose experiments with tar treatment at Mentone in 1901 laid the foundation for the subsequent success of the process. M. Forestier, of the Paris department of parks, reported at the same congress the production by heavy traffic of large quantities of black dust with an inflammatory effect on the eye, on a Paris street treated with westrumite, an ammoniacal solution of tar. Dr. Guglielminetti admitted the possibility that the vapors given off by freshly treated road surfaces, and the particles of tarry dust which it is impossible entirely to eliminate, may cause more or less pronounced cases of conjunctivitis. It has been pointed out more recently by M. Vasseur, one of the engineers of the French department of public works, that, while the proof of eye trouble is conclusive, it seems to be limited to automobile races over freshly tarred roads, and may be attributed, therefore, to the exceptionally intense conditions of traffic. Hence, he suggests that a means of prevention may be found in the use of suitable goggles. L. Philibert, on the other hand, is doubtful that eye troubles can be avoided in this way. Goggles may give effective prevention against dust, but it is neither safe nor practicable to make them absolutely air-tight, and thus impervious to tarry vapors. On freshly tarred roads, and during warm weather—and it may be noted that cases of conjunctivitis are much more frequent during the summer months—the vapors given off by the tar are responsible for the greater part of the injuries observed.

The classical investigation of ocular lesions of this character is that concluded last year by H. Truc and Charles Fleig, two physicians of Montpellier. Their exhaustive report, printed in the *Revue d'Hygiene* for February and March, 1911, presents the results of their own experiments in great detail, and summarizes the whole of the existing body of information relating to the eye troubles attributable to the action of tarry dusts and vapors. MM. Truc and Fleig set out to determine the mechanism of the injurious action of tar. To this end they made an extended series of experiments on the eyes of dogs and rabbits, designed to yield comparative data of the effects of dusts from treated and untreated roads. Repeated application of dusts from untarred roads, surfaced with either silicieous or calcareous metal, they found produce only slight or temporary inflammation, which is readily cured by natural processes. Only slightly more marked are the effects produced by dusts from old tarred surfaces. Dusts from well-preserved tarred surfaces, on the other hand, even if the treatment is of long standing, cause serious conjunctivitis, often assuming a purulent form, frequently resulting in chronic inflammation of the lacrymal gland. Finally, artificial dusts obtained by pulverizing a portion of a recently treated surface, which naturally contains a larger proportion of tar than ordinary dusts, produce extremely acute conjunctivitis, accompanied by eversion of the eyelid, first with an abundant mucous discharge and later with purulence. The results in the latter case are much more marked than those obtained with mixtures of tar with powdered chalk, pumice, or talc, or even with applications of raw tar, because of the absence from these substances of the noxious germs ordinarily found in road dusts.

Three factors, MM. Truc and Fleig conclude, enter into the injurious effect of the dust of tarred roads on the eye: First—and initially, at any rate, this is the most important—the caustic and toxic action on the mucous membrane of the eye of the constituents of the tar; second, the mechanical irritation of the dust; and third, infection by germs contained in the dust, which is greatly accelerated by the lesions produced by chemical and mechanical means. The validity of these conclusions has been widely assailed, largely on the ground that the methods of experiment employed by MM. Truc and Fleig bear no resemblance to the actual conditions of automobile driving. The experimenters justify their methods by comparing the human ocular apparatus with the more highly protected eyes of the dog or rabbit; still, their critics assert that the production of conjunctivitis was unavoidable under the treatment adopted by MM. Truc and Fleig, and that the results are of no value as proof that tar produces ocular injuries. M. Philibert, however, in the paper already referred to, finds it impossible to accept the theory that mechanical irritation alone is responsible for the effects observed in these experi-

ments. The prime cause, he says, exists in the complex constituents of the tar, and of these carbides and hydrocarbons of the phenol group would appear to be essentially the most active. M. Philibert bases his opinion, in part, on clinical observations among pitch workers, communicated by a number of Belgian physicians to the International Diseases Congress held at Brussels last year. Two industrial varieties of pitch are produced in the distillation of coal tar—ordinary black pitch, which is rich in phenols, and dry pitch, which contains only an insignificant amount. The eyes of pitch workers are constantly exposed to the action of pitch dust, and it is very common to find among them cases of conjunctivitis. The action of phenols in producing these injuries seems to be established by the fact that serious cases are wholly confined to workers in black pitch. The dry pitches, which contain no phenols, involve no specific danger.

Further evidence of the chemical action of the dust of tarred roads is afforded by the fact that the dust of ordinary roads is very rich in micro-organisms, which are materially reduced in number by tar treatment, and are sometimes expelled completely, at least while the tar is still fresh, the period when tarred dust has most serious effects on the eye. In 1904, two Swiss bacteriologists, H. Cristiani and G. de Michelis, reported the results of an investigation of the bactericidal effects of tar treatment. They reached the conclusion that, "from the bacteriological point of view, the air of tarred or oiled roads is infinitely better than that of untreated highways." Collaterally with their ocular experiments, MM. Truc and Fleig have determined the nature and number of bacteria in a large number of dust samples. In general, they find tar treatment diminishes the number of bacteria in road dust, but does not effect their complete expulsion. Tetanus, or lock-jaw, for example, has been produced in guinea pigs by inoculation with tarred dust.

Such is the evidence upon which tarred roads are accused of injurious action on the eyes of users. No one has yet had the temerity to suggest that it is sufficient to warrant the abandonment of tar treatment, and a great many advocates of surface tarring resolutely deny that any part of the evidence is credible. Assuming, however, that MM. Truc and Fleig have established their case, their final conclusion may well remain the last word in the dispute: "The ocular lesions produced experimentally, and the few cases of similar injuries observed in human eyes, do not appear to us to constitute any argument against the tarring of roads, a treatment in every other respect entirely satisfactory, and which, when properly carried out, is capable of diminishing by the suppression of dust, the chances of injury to the eye."

We may pause, before passing to the consideration of the effects of tarred roads on neighboring vegetation, to draw attention to three reports of injuries to fish life by storm waters washed from freshly tarred surfaces, which appeared last year in the columns of *The Surveyor*. R. B. Marston, editor of *The Fishing Gazette*, complained to a London newspaper early in May that trout and other fish had been killed in various English streams by the run-off from tarred roads. Col. R. E. Crompton replied in a later issue of the same paper that these damages were limited wholly to cases where roads had been treated with raw gas-works tar. They cannot occur if reasonable care is taken in selecting a tar which has no constituents, such as ammoniacal liquor, soluble in water. The proper material is distilled tar, which cannot possibly find its way into a stream. A subsequent correspondent, in reporting a case of wholesale slaughter of fish by the run-off of a freshly tarred surface, suggests that such destruction can be largely prevented by applying the treatment only in fine weather. When the tar has once set, the chances of any of its constituents reaching a stream are very much reduced.

Turning now to the effects of road tarring on vegetation, evidence of deleterious action is here both copious and credible; but it is a curious fact that it is supplied wholly by France, and almost exclusively by the avenue du Bois de Boulogne, in Paris, and the Bois itself. Dr. Guglielminetti, the founder and present secretary of the French anti-dust league, states that in the south of France, where tar treatment has been employed on an increasing scale ever since its earliest application, the owners of gardens bordering tarred roads have offered no complaints of injury, and are, in fact, among the largest subscribers to the league. When the first reports of injurious effects reached England in September, 1908, *The Surveyor* issued a circular letter to the municipal and county engineers of all localities where tar treatment was practiced. Not a single complaint of any seriousness was elicited. Of the large number of replies received, only one admitted the possibility of injurious action on vegetation not in immediate contact with the tarred surface. The majority of engineers who did not entirely flout the ieda of any possibility of damage suggested that the reported injuries might be due to the action of tar in actual contact with the roots of plants, combined with the exclusion of air and moisture from the soil. A similar inquiry instited in Germany produced

like negative replies, and the reports from Belgium are of the same nature.

But in Paris the effects are well marked, and have attracted the attention, not only of engineers and scientists, but of the press and public. The avenue du Bois de Boulogne was first treated in May, 1907, and subsequently in the spring and autumn of each year. Immediately after the spring tarring in 1908, signs of its destructive influence on vegetation appeared, and by late summer the condition of the plants and shrubs bordering the avenue was the subject of a good deal of newspaper comment. Dr. Guglielminetti persisted in denying that the tar treatment had produced any ill effects, but the question was settled beyond dispute by M. Forestier, curator of the Bois de Boulogne, who reported to the International Road Congress held in Paris in October, 1908, that surface tarring had indeed induced a disturbing condition in the trees, shrubs, and flowering plants under his care. The nature of the effects has been described by M. Honore, a prominent Parisian horticulturist. When M. Forestier made his report, the trees of the avenue were practically unaffected, with the exception of a few trees, the foliage of which was seriously injured within a few hours of the spreading of hot tar. Syringa and other shrubs, however, were seriously affected, their foliage dried, shrivelled, and spotted with brown and white patches. The lower part of a hedge withered within a few hours of the spreading of the tar, and did not recover during the remainder of the season. The leaves of geranium and begonia plants showed gray or brown patches, and the plants were clearly stunted in growth. Subsequently the effect on trees became progressively more marked. With each succeeding year they plainly suffered a decrease of vitality and of power of resistance to the destructive influence. Before the publication of M. Honore's article, several American walnuts and maples had been killed outright and removed, while alders were fast losing their vitality, and catalpa and chestnut trees were beginning to show unmistakable signs of infection.

So much for the evidence of destructive effects. The disclosure of the manner in which they are produced has been one of the results of recent researches on the effect of vapors on vegetable organisms, notably those of Marcel Mirande, whose papers on the subject give a very clear and complete exposition of the mode of action of tar on vegetation. The phenomenon of osmosis, the ability of gases to traverse thin membranes, is familiar to every student of chemistry. By virtue of this property, the vapors exhaled at ordinary temperatures by various liquid and solid substances penetrate vegetable tissues, and produce in plant cells the well-known phenomenon of the contraction of the protoplasmic mass and its separation from the cellulose membrane. If plasmolytic action is continued long enough, the life of the cell is destroyed, and, in this event, the plasmic tissues having lost their osmotic properties, water is forced into the cellular spaces and also to the exterior of the plant. This water contains in solution various substances, some of which often crystallize out on the surface of the outer skin. Within the tissues, substances formerly localized in the living plant are permitted to become freely diffused. Among them, chemical reactions, in the majority of cases, produce new substances, of which some, frequently colored, remain in the cells, while others, of a volatile nature, are exhaled into the atmosphere.

Under the influence of a large number of vapors, plants exhibit the phenomenon of discoloration, of gas liberation, or both phenomena together. Exposure to a mixture of different vapors produces an effect which is the summation of the individual effects of the various constituents. And it is important to note that before the action of vapors has progressed far enough to cause the destruction of the cells, even while the plant is still green, there occurs arrest of the function of the chlorophyl. The assimilation of carbon is suspended. In short, the plant is anesthetized, an almost complete suppression of the respiratory function succeeding a short period of very pronounced activity.

Leaves of the laurel-cherry exposed in a confined space to the vapors exhaled by tar at ordinary temperatures show both blackening and gas liberation at the end of about two days. Leaves with very thick skin—syringa, chestnut, and the like—are covered with yellow or brown spots in less than twenty-four hours. When heated, even very slighty, tar exhales vapors extremely rapid in action, producing discoloration in a few minutes, not only in a confined space, but also in the open air. M. Mirande has made experiments in the open with plants suspended over a raised platform about forty feet square in area, exposed to the direct action of both sun and wind. Tar was spread on this platform at a temperature of 70 to 80 degrees C., the usual temperature in road-tarring practice. Leaves attacked by the vapors rising from the hot tar were killed with great rapidity. When cooled, and even solidified, the tar continued to exhale vapors which produced effects more or less rapid and severe according to the temperature, the itensity of the sun's rays, and the wind conditions. Specimens of the castor oil and tobacco plants, suspended at a height of twenty inches

above the tar, suffered a gradual blight. Plants hung at a height of forty inches suffered less, some not at all, but the results were quite sufficient to prove that the effects produced by tarry vapors in the open air differ not in kind but only in degree from those observable in the laboratory.

Not all the injuries to vegetation observed in Paris are to be ascribed to the action of vapors arising from the the tar on the road. It is generally conceded that the vapors exhaled from particles of tarred dust are responsible for some part of the deleterious effects; but the relative intensity of the action of tarred dust and that of the vapors given off by the road itself is still a matter of controversy. An experimental investigation reported by M. Mirande has shown the action of tarred dust in some cases to be surprisingly small. M. Mirande was prepared to find that the dust of tarred roads, if applied to plants in sufficient quantity, would produce effects comparable in intensity with those of tarry vapors. Leaves in closed vessels, copiously sprinkled with a mixture of tar dust and sand obtained from a freshly treated road, showed signs of discoloration only after five or six days. Under similar conditions dusts of fresh asphalt or bitumen produce blackening very rapidly. M. Mirande's experiments in the open gave purely negative results; plants sprinkled with dust of tar, asphalt or bitumen over several successive days of high temperature and bright sunlight showed no visible sign of alteration. Hence, M. Mirande concludes that, except in very rare instances, the vapors exhaled by tarred dust in the open air are too small in amount and too rapidly disseminated to have an injurious effect on vegetation.

On the other hand, M. Griffon, of the Paris Institute of Vegetable Pathology, who has been investigating the effects of road tarring on vegetation for the Paris municipal authorities ever since the first signs of injury appeared, has published results which prove beyond a doubt that, on certain classes of plants at least, the action of tarred dust is decidedly injurious. The results of M. Griffon's laboratory experiments on the effect of tarry vapors confirm those obtained by M. Mirande; his experiments in the open air, however, have yielded no positive evidence of deleterious action. Indeed, his observations in the Bois de Boulogne lead to the belief that during the process of spreading and up to the opening of the road to vehicular traffic, the effect of the vapors rising from tar is practically nothing. M. Grigon's numerous experiments with tarred dust, spread on the leaves of many varieties of plants under natural conditions, show, on the other hand, that plants of aqueous and delicate tissues are susceptible to pronounced injury, although many species of ornamental trees and shrubs are apparently immune. On the basis of the results of direct experiment, M. Grigon is at a loss to explain the withering of the foliage of chestnut and other trees in various parts of the Bois. It may be, he suggests, that the period of exposure, the fineness of the dust, the direct action of the sun on the tarry particles, have an important, tho indeterminate, influence; while it is unquestionable that the age of a tree, its condition, and, above all, the environment of its roots, will go far to determine its susceptibility to injury.

To the last point M. Mirande also adverts, in summing up the conditions under which injurious action may be expected to occur. In urban streets, he says, the exclusion of air and moisture from the soil by a coating of tar may be a most important adjunct to the direct action of tarry vapors on trees. Direct action will begin when the air is sufficiently charged with tarry vapors, a condition promoted by hot and dry weather and absence of wind. The tarring of confined streets, bordered with high houses, may, therefore, result in injury to shade trees; and the same is true of avenues, wide and open, yet bordered with a dense vegetation. The first stage of the action is anesthesis. Agitation of the air may dissipate the vapors and arrest their action at this point. But if anesthesis is too frequent the result is the same as if the tarry vapors had been permitted to continue their action. Leaves, and even whole trees, gradually lose their power of resistance, and finally perish.

M. Honore recommends that where the safety of plants is the prime consideration, tar treatment of roads should be entirely avoided. Before condemning for park purposes a process which offers so many and so important advantages, M. Mirande and Griffon prefer to await the results of practical experiments on a large scale. To M. Gatin, the latest investigator to communicate his observations, however, the Bois de Boulogne supplies all the data which can be obtained from practical experiment. Certain of the drives in the Bois are tarred for only part of their length, and offer abundant opportunities for comparing the condition of the vegetation on the tarred and untarred portions. Taking two very popular drives, M. Gatin calls to witness that the trees of the tarred portions are distinguished by less abundant, less luxuriant and less healthy foliage, by premature falls of leaves and by a less thriving condition of the young branches. The effects are less marked in the upper than in the lower branches. M. Gatin presents the proof in quantitative form, having made innumerable comparative measure-

ments of leaves on the tarred and untarred portions of these two drives, which, in addition to being much traveled, are exposed to the direct action of the sun.

Comparing the condition of the vegetation bordering these drives with that of trees along other tarred roads little frequented and heavily shaded, M. Gatlin reaches the conclusion that only in certain cases, and particularly when a road is open to the direct action of the sun and subjected to very heavy traffic, is surface tarring able to exercise an injurious effect on neighboring vegetation.

The Prefect of the Seine has recently appointed a commission of twenty-six members, including Dr. Guglielminetti and MM. Gatin, Forestier, Honore and Griffon among other highway, chemical and horticultural experts, to investigate means of preventing the injurious effects of surface tarring. Comparative observations in the open, and further laboratory investigation will yield, it is hoped, precise data of the action of the tars now in use. Another line of inquiry which promises useful results is the investigation of methods of eliminating from tar the injurious constituents, which has been taken up by a number of French chemists.

We cannot conclude better than by quotation from the conclusions of Dr. Guglielminett's recent paper: "It is to be hoped that tar treatment, the best solution hitherto discovered of the problem of adapting roads to automobile traffic, will not be found to present disadvantages great enough to dictate its abandonment. If, however, the observed injuries to vegetation are actually as great as reported, it would seem impossible to use along tarred roads ornamental plants highly resistant to deleterious action, and, at the same time, to eliminate from tar its dangerous elements.

"For the present, the important matter is to suppress tarred dusts. It is a grave error to suppose that tar treatment alone guarantees dustlessness. Tarring does, indeed, suppress almost entirely dust produced by the wear of the road surface, but it is of no avail against dust carried by the wind or by vehicles. This imported dust it is necessary to combat by watering more or less frequently, according to the weather conditions and the intensity of traffic. In any event, if the proximity of vegetation forbid the application of surface tarring to streets bordered by delicate trees and flowers, there remain to be tarred enough roads with neither trees nor flowrs, or bordered with a vegetation sufficiently hardy successfully to withstand its destructive influence."

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## PURIFICATION OF BATH WATER.

By Frank C. Perkins, Buffalo, N. Y.

THE accompanying drawing shows a section of a unique English equipment for the sanitary purification of the water for swimming baths, as developed at Darlaston.

Swimming baths are usually emptied and refilled with fresh water twice a week, and sometimes three times. As a matter of fact, even three times a week is not really sufficient, from a sanitary point of view, as it gives results far below those which are easily attainable by the modern method of continuous purification and re-use.

Assuming that the water is changed twice a week, and fresh water has to be paid for at the rate of 12 cents per thousand gallons, then the interest on the first cost of a purification plant would be iess than half the amount paid for fresh water on the assumption that the swimming baths are in use six months in the year. In case the water is changed three times a week, then the interest on capital outlay would represent less than one-third the cost of the water. It is claimed that the working costs are low, as these only entail running a pump and the slight attention for washing the filters, no increase in the present bath's staff being necessary, and consequently this item is practically nil. The depreciation charges may be taken on the basis that the life of the tanks and filter drums is equal to that of a steel bridge, or fully fifty years.

But a much more important matter than mere cost is the aspect of the whole question from a public health point of view. The modern method of purifying swimming bath water for re-use over and over again by aeration and filtration has met, in some quarters, with a good deal of opposition, chiefly because the idea of using water over and over again for bathing purposes has been disliked. This state of affairs results almost entirely from want of adequate explanation of the whole subject.

In providing a mechanical filtration plant for the purification of bathwater,

one is imitating nature's own process of aeration and filtration. Bath water is continually liable to contamination from germs of disease derived from the human body. One of the most important conditions then that a filter for bath water should fulfill, is that its efficiency as a means of intercepting disease germs should be high.

There are, however, other difficulties with which the bath superintendent has to contend, such as the growth of green algae, which takes place rapidly in sunlight, and the production of a slimy deposit on the bottom and sides of the bath. Usually this latter can only be removed by the use of muriatic acid. The use of alumino ferric introduced directly into the bath is objectionable, as it increases the deposit at the bottom of the bath and has the further disadvantage of making the bathers' hair sticky.

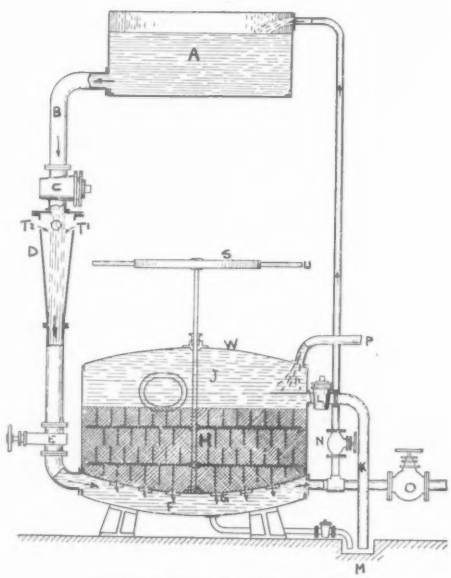
It is maintained that these difficulties are avoided as follows: The alumino ferric is used in an insoluble form e. g., as hydrate of alumina, which is then introduced into water on its way to the filter, on the surface of which it forms a film, which has the power of intercepting green algae, diatoms, and other organisms giving rise to slime on the bottom and sides of the bath.

This filter was tested on canal water in a very populous district and in which there is a great deal of bathing in the summer months. The water is stagnant and very impure from a bacteriological point of view, i. e., it swarms with microorganisms or germs, but actual counts of the germ colonies before and after filtration show as high a degree of purification as is effected by nature's own filters, such as geological strata permeable to water, such as chalk. This canal water is further contaminated by sewage, and abounds in green algae and diatoms, the purification from all of which was thoroly efficient.

It may be of interest to consider the actual condition of swimming bath water under the old system and the new. By the old system is meant the system of changing the bath water for fresh water twice, and sometimes, tho rarely, three times per week, and it is assumed for the sake of argument that it is actually changed three times a week.

If changed at the end of 48 hours the bath authorities must, at the end of six hours, consider it quite fresh; but it has been proved by actual analysis that bath water, which has been continuously purified by aeration and filtration and used over and over again, is as pure continuously as the water periodically changed for fresh is at the end of 6 hours, a time when the latter is considered quite fresh. No continuous purification apparatus has ever given a worse result than this. Better results have been attained, in some cases the continuously purified water being actually equal in purity to tap water for drinking purposes. Clearly, then, if the periodically changed water is to compete in purity with the continuously purified water, the former will have to be changed every 6 hours, which is practically impossible.

What then must be its condition when the water is allowed to remain in the bath for from 2 to 3 days without change. As a matter of actual analysis, it is exceedingly impure, and swarms with germs or bacilli derived from the human body. Surely this is the unsanitary system against which prejudice ought to exist. The method of continuous purification does, it is true, use the water over and over again, but it uses water which both from a chemical and from a bacteriological point of view, is in a reasonable state of purity, attained as before pointed out, by an artificial imitation of nature's own process.




FILTER FOR BATH WATER.

Considering again the pathogenic bacilli, or the germs of disease. When introduced into the blood of man or animals, they produce by their activities certain poisonous products called toxins. These microbes of disease derive the necessary food for their own sustenance from the human blood, and throw off into the blood products which may be regarded as excrement. It is this excrement, then, which is the toxin or poison which produces the disease. The truth of this theory has been proved in the case of diphtheria. tetanus (lock-jaw) and others, and is

probably generally true. Serums or antitoxins are introduced into the blood as antidotes for these poisons, or destroyers of the poison-producers.

Diseases produced in this way are termed zymotic because their course bears a resemblance to the process of fermentation. The following are some of the diseases now known to be attributable to the activities of specific micro-organisms or bacilli: Plague, cholera, typhoid fever, dysentery, tuberculosis, anthrax, tetanus (lock-jaw), erysipelas and influenza. In fact, it is now pretty generally recognized by the medical profession that every disease to which man is subject may be directly due to a bacillus special to the particular disease, altho the micro-organism in question has not, in the case of every disease, been isolated, identified, and proved to be the cause of the disease.

During the ordinary course of working the English mechanical filter of the Rubery-Owen type, seen in the illustration, the valves C, E and L are closed, but when it is necessary to cleanse the filtering material, the supply of unfiltered water, which usually enters the filter at P, is stopped. The valve L is then opened, and the water in the space J flows to the drain M via K and L. L is then closed, and the valves E and C are opened. Clean water now passes via B and C thru the cone D. It will be noted that this falling stream of water induces a current of air which is drawn in through the aperatures T1 and T2 in the top of the cone. This air is then carried forward by the falling stream thru the valve E into the space F underneath the filtering material H. Thence the water and air passes upwards through the perforated plate G, which is fitted with specially constructed screens, and the filtering material H, the air finally escaping by an air pipe not shown.

While the water and air are flowing thru the filter bed, the agitator is rotated with the aid of the horizontal wheel S and the levers U. This can be done by hand, but in large installations, mechanical gearing for power is provided. The impurities are now floating about in suspension in the space J, and by opening the cock L they flow away to the drain.

The application of aeration to swimming baths is novel. A much larger volume of atmospheric oxygen can be dissolved in a given volume of water in this way than can be done in any other manner and the loss of heat on circuit is much less than when any form of apparatus for the production of a shower is employed.

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# GERMAN DWELLING REGULATIONS.

**By Dr. Robert Grimshaw, Dresden, Germany.**

THE necessity of having a general German law concerning dwellings is coming to the fore. As an example, I may say that in Berlin proper there are 600,000 persons so closely housed that there are five persons or more in each room; and 335,000 school children are entirely without a room in which to play, by reason of the fact that everywhere one sees the sign, "Playing in the courts and corridors is forbidden."

These figures show the boundless misery in these crowded quarters. The example noted as to children playing shows what a wretched childhood so many young beings have, hedged about at every turn by "forbidden," "not permitted," "not allowed," "prohibited," and every variety of prevention, caution and threat. In some towns and cities steps have been taken to give the youngsters a chance, in order that they may grow and thrive; but these steps have been and are still voluntary on the part of the municipalities.

At present there are many in the Imperial Parliament who think that it is time for the general government to step in and regulate the housing question, as it has that of workmen's insurance, by a law for the entire empire. A good many resolutions have been brought before Parliament, some from very altruistic motives, some from the standpoint of national defense, and others by politicians, in order to curry favor with the proletariat. The result of all this is that there has been appointed a commission to study the dwelling question and frame a law which will be brought before the Parliament for discussion. This commission held its first sitting April 18, this year.

It is remarkable that at the very first there was a paper from a commissary of the general government (that is, of the "allied governments") in which the government stated that it did not consider it its duty to mix directly in the affairs of the various governments (Prussia, Bavaria, Saxony, etc.), but greeted with pleasure all steps tending to the improvement in the condition of the people, and would work in harmony with all suggestions tending thereto. This might be said to be a bucket of cold water in the face of the commission, which put itself on record as saying that the standpoint of

the general government was entirely false. The empire, as such, is just as competent to act and justifiable in acting in this as it is in the matter of the care of the public health. The action of the general government is absolutely necessary, because the various states composing the empire, with the exception of Hessen and Bavaria, have taken no action in the matter.

From the initiative of the various municipal bodies one cannot expect very much. In solving the dwelling problem there must be a limit drawn against the heavy capitalists, just as was drawn in the matter of protection of the workmen. The general government must take the initiative in compelling the municipalities to act. It is less a question of police power than one of general welfare.

The new commission will, despite the unfriendly attitude of the allied governments, be able to work with advantage, and finally to compel the Ministry of the Interior to take action. For this reason the result of its work will be the outline of a general law which will serve to animate the general government to definite action.

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# PAPERS BEFORE THE AMERICAN WATER WORKS ASSOCIATION.

## LAYING WATER MAINS UNDER STREAMS.

By M. L. Worrell, Meridian, Miss.

THE first work of this nature, in my own experience, was accomplished while Superintendent of Public Works at Rome, Ga., having in charge the waterworks, streets and sewers of that city, during the three years beginning January 1, 1908. There were three crossings constructed, one thru Silver creek and two thru the Etowah river at different points.

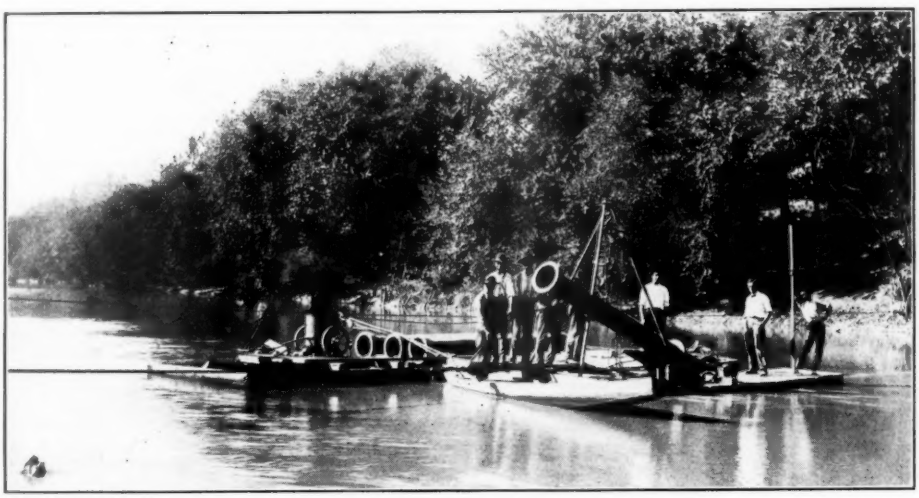
The creek was to be crossed under near a highway or county bridge, and it was deemed advisable to lay the pipe on the bottom of the creek, properly secured, rather than to suspend it from the bridge or to lay it on the floor thereof, on account of the sudden rises and terrific floods the stream is forced to carry at times, it being the drainage outlet of a large area of mountainous country.

At the point to be crossed the creek was sixty feet wide between banks at street level, forty feet wide at low water, and at ordinary low-water stage twelve feet deep. Material used was cast iron, made with Ward's flexible joint, sixteen inches in diameter, weight about 87 lbs. per foot or 1,034 lbs. per joint of 12 feet, costing 2 cents per lb. delivered in Rome. The limit of deflection of this joint was said to be fifteen degrees, tho we did not find it safe to use the limit, twelve degrees being, in our experience, safer. The pipe line of five joints, twelve feet each, was made up or constructed on a platform spanning the creek at the level of the street, then lowered by means of proper tackle into the stream, the two ends being kept clear of the water for later joining to the water mains on each side of the creek, and the submerged part being gradually lowered, thus allowing deflection, until it rested on the bottom. The pattern of the pipe bell and spigot that laid under the stream being different in design to the ordinary cast-iron pipe, the two were connected by short pieces designed by the consulting engineer, J. N. Hazelhurst, who was in responsible charge of both engineering and construction. After the Ward pipe was attached to the street main a test, hereinafter described, was made for leakage, this test revealing a loss of 28,000 gallons per day of twenty-four hours. This being excessive, a diver was sent into the water to ascertain the cause and exactly locate same, the examination revealing that the limit of safe deflection had been exceeded, causing three lead joints to leak very badly. We then detached the creek line from the main on each side of the creek, raised the entire line, recaulked all joints, partially filled the bottom of the creek with small boulders, using several cubic yards in securing a good foundation and in reducing the deflection to about twelve degrees, again lowered the pipe line into creek, joining to regular main, when the next test showed only small leakage of about 380 gallons per day. Later this joint was again caulked and the leakage reduced to quite a small quantity, about 150 gallons per day. The foundation made by the loose boulders was added to, the pipe being covered and otherwise made secure, since which time no trouble has been noted, tho many heavy rains have caused large floods to be thrown against it. This work was done in the month of September, 1908. The last test made by the writer was in the month of December, 1910, and was made both for leakage and to ascertain if the pipe had moved, even slightly, down stream No

movement was noted, and the leakage had not increased. The cost of this work approximated $300, everything included, or $5 per lineal foot.

The first river crossing was at Second avenue, north of the East Rome highway bridge spanning the Etowah river, the height of the banks being about forty feet above low water. We prepared for this by providing the necessary wire cable, stretched from bank to bank, to which the trolleys for carrying the supply boat and pontoon raft were attached. The pontoon raft or boat, from which we were to lay the pipe in the river, was constructed as follows:

The flotation was provided by twenty-five empty oil barrels lashed together with ½-inch manilla rope, the barrels being laid in three rows, head to head, row No. 1 having ten barrels, row No. 2 five, and row No. 2 ten, the three rows being laid parallel thus leaving a "slot" in the middle row, same being to the stern of the raft. The barrels having been so arranged, a deck was built upon them, the material used being pine lumber, 2x12, of the necessary length to cover the barrels as laid out, the barrels being secured under the deck by drop pieces or retaining "sleepers" enclosing the outfit, making a strong raft, extremely buoyant, and practically impossible to sink or capsize. The carpenter work, when completed, left the "slot" ready for the purpose for which it was designed—that of laying the pipe thru it. The woodwork was so left as to make it easy to transfer the "slot" from the rear to the front for purpose later described. Two trolleys, with the necessary tackle for operating the raft, were attached to the wire cable and secured to the raft; a supply boat, utilized from a river flat or ferry boat, was provided and attached to the wire cable and almost immediately beneath it, this boat carrying extra lengths of pipe, pigs of lead, yarn, melting pot, etc. The pontoon boat carried nothing but a tripod made of 2-inch wrought-iron pipe, attached to flattened ends by a suitable bolt, supporting a triplex chain-block, this being for handling the pipe in process of laying in bed of river. The completed outfit was propelled across the river by means of a lead or hand rope. The first joint was secured to a "dead-man" on the bank, by means of a heavy chain, the outfit pushed off, the bell of the pipe forward, the second joint fitted therein, the joint poured and caulked, outfit moved forward again with the next and each succeeding pipe until the shore had been reached. The "slot" was then moved forward, or to the front end of the boat by removing a part of the deck, which had been constructed for the purpose, removing the short row of five barrels to the stern, placing the movable portion of decking to the rear, thus leaving the last joint of pipe ready for attachment to the forward shore of the river and to the ordinary 10-inch cast-iron pipe. The short joints or pipe for joining the Ward with the ordinary cast-iron pipe were three feet in length, or made to lay three feet, one having the standard bell on one end and the flexible joint bell on the other, and one with the standard bell and the flexible joint spigot. After the operation of laying the river crossing was completed, security was insured by anchoring or attaching two joints on each



LAYING PIPE UNDER WATER, ROME, GA.

end of the river pipe to "dead-men" permanently constructed in the banks, heavy hog chains being used for the purpose. Before the work of laying the pipe was begun the river bottom was sounded, it being found to consist of solid rock, slaty limestone, with three ledges running longitudinally, each ledge having practically the same elevation. Those ledges were cut or notched, and the pipe, while being laid, was fitted therein, the notches being made by blowing away a portion of the ledge with dynamite. These notches secured the pipe from deflection down stream, and provided safe anchorage for the pipe without the necessity of providing a channel in which to lay it. The length of this river crossing was 216 feet, and the time required for preparation and actual laying was about six days. The photograph shows how the pipe-laying outfit was operated.

We used a construction superintendent, who also performed the duties of foreman; a straw boss or gang foreman, and five able-bodied negro laborers and one water boy, the pipe laying cost being about 35 cents per foot. This particular job cost about $700.

We crossed under the same river at Broad street with 12-inch pipe, the river being somewhat wider and deeper, no notches in the rock having to be cut and no channel to be prepared, the cost of this job approximated $900.

On each side of the stream thru which the pipes were laid we placed valves for cutting off the crossings in case of emergency, and it was by means of by-passing these valves that we were enabled to make the tests heretofore mentioned. One of the valves at each crossing was enclosed in a telephone or coffin-shaped manhole, in which manhole we tapped the main on each side of the valve, the inlet tap being ¾-inch and the outlet tap being 1-inch. Lead connections, properly equipped for the purpose, were attached to the taps and the other ends connected to a 1-inch meter of great sensitiveness, thus by-passing the valve, which, along with the other across the stream, was shut off, the water turned on at the ¾-inch inlet tap slowly, and as slowly let out at the outlet 1-inch tap. As soon as the meter and outlet connection had filled, the meter ceased to operate, apparently showing that we had no leaks in first river crossing. Not entirely satisfied with this, we removed the meter, blew thru it to show whether it was "struck" or not, replaced it, repeated the operation of by-passing, and experienced the same effect. Both river crossings showed the same results at the first and all subsequent trials, made at quarterly periods during term of my engagement at Rome, three years. The creek crossing did not show any deterioration. I prepared for and made similar tests of the crossings already laid, two in number, at other points, but they were not quite so satisfactory, tho the leakage observed would not justify reconstruction of the old lines.

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## CONTINUOUS SETTLING BASINS.

By Alexander Potter, Consulting Engineer, New York City.

THE city of Muskogee, Okla., has under construction a number of improvements to its water supply and sewerage system together with a garbage incinerator plant, with which improvements the author has been identified as designing and supervising engineer. The water improvements consist of construction of an intake tower in the Grand river, some two thousand feet above its junction with the Arkansas river, a 54-inch concrete-lined intake constructed in rock tunnel under the Arkansas river, and 2,500 feet long, the installation of additional pumping units, both high and low lift, of a water purification plant, the reinforcement of the water distribution system, and the construction of a six million gallon equalizing reservoir, consisting of a 50-sided polygon, whose walls are built entirely above the ground, each side consisting of an Ambursen dam section.

That portion of the water purification plant now under construction is designed to apply sedimentation assisted by coagulation with ferrous sulphate and lime. Provision is made so that ultimately mechanical filters can be introduced if they should be found necessary. In this article, the settling basin only will be discussed.

The new settling basin for the Muskogee water works is a reinforced concrete structure, 212 feet square on the inside. When filled to a depth of 18 feet, this basin holds over six million gallons of water. A curtain wall of reinforced concrete divides the basin into two compartments. The first or smaller of these compartments, 212 feet long and 52½ feet wide, has the bottom perforated and underdrained. A distributing trough, 3 feet 6 inches wide and 5 feet deep, extends the entire width of the first compartment. The water enters the first compartment

from the distributing trough, supported on the counterforts through a series of 8-inch round openings spaced two in each panel formed by the counterforts. A 4-inch concrete baffle or stilling wall in front of the distributing trough extends the entire length of the basin. The water passes thru the first compartment over the curtain wall into the larger compartment. Balanced valves in the bottom of the curtain wall equalize the pressure on the wall during filling. A collecting channel of the same size as the distributing channel is located at the far end of the basin, extending the entire width of the basin. The water enters the collecting channel thru a series of 2-foot weirs located one in each panel. The basin is designed to operate continuously.

A settling basin operating continuously possesses a number of advantages over a basin which is operated intermittently. There is first a considerable saving in the size of the settling basin when the settling is carried on continuously. This saving may amount to as much as 50 per cent. over an intermittent installation in which two basins are used, decreasing, of course, somewhat the number of basins. When a settling basin is operated continuously, the capacity of the basin, except for the sludge displacement, is always available, which is not the case with the intermittent type. There is no reason whatever why in a properly designed basin the settling efficiency should be impaired by the disturbance at the inlets and outlets.

The author wishes to call attention at this point to the method to be used in the Muskogee settling basin for removing the settled sludge from the first or smaller compartment without interfering with the efficient continuous operation of the plant. The small compartment is underdrained. These underdrains consist of 3-inch vitrified pipe drains, each perforated with a hole 19/32 inch in diameter. The underdrains are laid with asphalt joints, and are arranged in five zones. The collecting channel for each zone is 8 inches deep and 14 inches wide. Each channel is covered with a 24-inch square reinforced concrete slab, 3 inches thick, perforated with a 19/32-inch hole in the center. A 12-inch cast iron pipe is carried from the collecting channel to the sludge chamber.

The sludge valves are 12-inch hydraulically operated valves of the Renssalaer make. Each valve controls a zone approximately 212 feet long and 10½ feet wide. In each zone are 405 holes or perforations, each 19/32 inch in diameter, spaced 2 feet on centers in rows 27½ inches apart. As the amount of sludge deposit depends principally upon the distance from the distributing trough, the arrangement of the zones is such that the sludge will be fairly uniformly deposited over the area of any one zone.

The intervals between openings of the valves and the length of time they remain open at the outlet end of the sludge drains will vary with the condition of the raw water. The precipitated solids should not be allowed to accumulate long enough to pack over the openings. The sludge valve should be closed at once when the discharge, which is visible at all times, begins to show up clear. If we could go down and examine the bottom immediately after the sludge is drawn off, we would find a cone-shaped depression in the sludge at each of the perforations. Between the perforations, some of the sludge would be left standing in the form of wedges and pyramids. The angle assumed by the side slopes of the sludge depends somewhat upon its character, and also the frequency with which it is being drawn off. Assuming a side slope of 45 degrees for the sludge, which is considerably steeper than most sludges stand in water, the amount of sludge that is out of reach of the underdrains in this particular case would cover the bottom. If considered uniformly distributed, a depth of 6 inches. This means a decrease in the capacity of the first compartment of approximately 2.8 per cent.

Great care should be exercised in the design of a system of underdrains such as has been outlined, to insure its successful operation. The underdrains and perforations must be designed so as to give the same amount of suction for all of the perforations or holes in any one zone. Otherwise, clean water will be drawn in at those points where the suction is greatest, and while sludge is still covering a large part of the opening. Such a condition not only leads to a great waste of water, but results sooner or later in the partial clogging of the perforations, and ultimately in the permanent break-down of the underdrain system. To be efficient, the water must enter the perforations at as high a velocity as it is practicable to obtain. This means that, especially in a shallow tank, the frictional losses in the underdrains and effluent pipes, and the velocity head at the discharge end, must be kept down as much as possible. In the average plant, the area of each valve should approximate the total area of the perforations tributary to the valves, preferably less, altho this proportioning is claimed to be protected by patents. Ample provision should be made to prevent excessive pressures developing in the effluent pipe from water hammer. Valves 8 inches or smaller, can be readily operated by hand; larger valves should be either hydraulically or electrically operated.

The author has used this system of sludge removal with great success. It is in use in the settling basin of the water purification and softening plant for the city of McKeesport, Pa., put in operation in 1908; and in the settling basin of the municipal water purification plant in the city of Georgetown, Ky., in operation since May, 1911. Both of these plants were designed and constructed by the author, and to the best of his knowledge there has been no break-down at any time in the underdrain system.

The larger compartment of the settling basin, comprises three-quarters of the total capacity of the basin. It has a sloping bottom draining to a sump. A 12-inch cast iron sludge pipe is carried from this sump to a 24-inch vitrified pipe drain located outside of the basin. It is expected that fully 85 per cent. of the suspended solids will settle out in the first compartment. For this reason it was considered necessary to underdrain the larger compartment. Whenever the sludge reaches a depth of several feet in the larger compartment, the operation of the basin will have to be suspended and the basin cleaned. The turbidity of the river water, however, is normally low, and it is not expected that this will happen more than once in several years.

The cost of constructing the underdrain system for the removal of the sludge, is not great when compared with the economy resulting in the cost of operation. By removing the sludge daily, the capacity of the basin is not impaired, as is the case when the deposits are allowed to accumulate. In the former case, the efficiency of the basin is maintained, whereas in the latter the accumulated deposits of settled solids displace more and more of the water content of the basin, often to an extent which seriously impairs its efficiency. The full capacity of the basins is most sorely needed when the river is turbid, but it is then that so much space is occupied by accumulated solids which cannot be removed because every inch of space is needed to assist in settling. The emptying and cleaning of a basin is a costly operation, especially in winter time, and is to a very great extent avoided, even if only a portion of the basin is properly underdrained.

The amount of water that passes off with the sludge in the system just described is not excessive. It is estimated that in the Muskogee plant this amount of water will not exceed one-sixth of 1 per cent. of the water treated.

The basin is being constructed of reinforced concrete. The value of reinforced concrete construction for water works purposes is perhaps not so fully appreciated as it should be. The advantages of a reinforced concrete structure over one constructed of plain concrete, together with the resultant economy in the cost of construction, are far greater than the profession has been ready to admit. The structure in question may safely be said to bear out this statement. Our knowledge of reinforced concrete is comparatively recent. It is only in the last decade that we have been able to produce in the field a product whose physical properties are sufficiently uniform and well understood to enable us to construct the wonderful structures now possible. It is but a question of time, and that only a very short one, when reinforced concrete will entirely displace the heavy masonry and plain concrete structures so common in the last decade.

Reinforced concrete differs materially in many respects from plain concrete. The physical properties of plain concrete can be best understood by comparing it with one of the natural stones, such as sandstone, which is very closely resembles. Reinforced concrete, on the other hand, is an entirely different material. Un-reinforced, the material is brittle, possesses very little ductility and tensile strength; reinforced, the material is tough, possesses considerable ductility and great tensile strength. In many ways, the properties of reinforced concrete are very similar to those of structural steel, and it also is adapted to many of the uses to which structural steel is put.

It is possible to construct a monolith of plain concrete of considerable proportions. However, it is but a question of time when the unequal settlement of the foundation, always present except when the foundation is solid rock, the shrinkage and temperature stresses set up in the mass, destroy the continuity of the structure. On the other hand, it is possible to construct and maintain as such a reinforced concrete monolith of very large proportions.

There appears to be some doubt that thin sections of reinforced concrete are suitable for water-tight structures. There need be no fear whatever that trouble will occur if the work is carried out as it should be. The water-tightness of concrete depends principally upon the amount of cement present, provided the sand and stones or gravel are properly proportioned. Six bags of cement per cubic yard of concrete is ordinarily sufficient to produce a water-tight mixture. This amount, however, should be increased when the hydrostatic head is considerable.

The author is opposed to the use of waterproofing ingredients or water-proofing applications. Both increase the cost of the concrete work considerably. It is far better to put the value of the waterproofing materials into the concrete itself by adding more cement. The use of a waterproofing ingredient or application

tends to poor construction work, the contractor counting upon the waterproofing to help out materially careless construction.

The author, from his study and experience in the construction of tanks and reservoirs, has reached the conclusion that leakage may be due to any one of the following causes:

1. Faulty construction.

(a) Lean and porous concrete work.

(b) Inexperience and carelessness in carrying out the design.

2. Faulty design.

(a) Weak details at the connections.

(b) Excessive secondary stresses at connections.

(c) The use of too high unit stresses in steel and concrete.

Faulty construction can be rectified to some extent, but often only at a considerable cost, by waterproofing the structure from the inside. Leaks developing through faulty design are, on the other hand, always difficult to master, and in many cases very little can be done to remedy the unsatisfactory condition of the completed structure. To guard against the production of lean concrete work, the author's specifications provide that all cement used in the work should be paid for separately.

As 10 feet of the basin is constructed below the original surface of the ground, it was decided to use counterforts instead of buttresses to save excavation. The counterforts are 15 inches thick, spaced 13 feet 4 inches on centers. The side walls of the basin are 12 inches thick on the top, widening out to 18 inches at the bottom. The floor of the basin is 6 inches thick in the larger compartment, and in the smaller and underdrained one 9 inches. The basin, including the floor, is constructed and reinforced as a monolith. No expansion joints whatever are provided. There will, however, be an expansion joint between the present basin and future extension.

Horizontal construction joints are used freely. The unfinished surface is always left in as rough a condition as possible, but never roughened up after the concrete has partially set. The author has found that this roughening often loosens the stone in the concrete, but not sufficiently so that they can be removed, a condition which is apt to impair the water-tightness of the structure. To start a day's work, the surface is thoroly cleaned with wire brushes and water, and a cement liquid mortar mixed in the same proportions as the mortar in the concrete, is poured over the old work to a depth of ½ inch. This method always gives a good water-tight horizontal construction joint.

Vertical joints are permitted only in certain places, as these joints are very difficult to make water-tight.

The specifications call for two coats of neat cement wash to be applied with a white-wash brush on the inside of the basin. Both of these coats are to be applied to the concrete when damp but not wet, and the second coat must be applied before the first one has had time to get very hard. Any leakage that may develop in the basin previous to its final acceptance, must be repaired by the contractor, at his own expense, no additional compensation whatever being permitted for this work under the specifications. The work is being done so thoroly that very little leakage, if any, is expected when the basin is filled for the first time.

The contract for the construction of the basin was let to W. W. Fuller, of Muskogee, Okla. The following is an approximate estimate of the quantities of material required, together with the contract unit prices:

| | | | |
|---|---|---|---|
| 18,000 cu. yds. of earth excavation | @ | $ 0.40 | $7,200.00 |
| 1,930 cu. yds. 1:2:4 concrete | @ | 6.25 | 12,062.50 |
| 820 cu. yds. 1:3:6 concrete | @ | 5.40 | 4,428.00 |
| 4,000 bbls. of cement | @ | 1.40 | 5,600.00 |
| 220,000 lbs. of steel | @ | 0.035 | 7,700.00 |
| 3,520 ft. 3-inch vitrified sewer pipe | @ | 0.20 | 704.00 |
| 800 ft. 6-inch vitrified sewer pipe | @ | 0.20 | 160.00 |
| 220 ft. 24-inch vitrified sewer pipe | @ | 3.50 | 770.00 |
| 1 manhole complete | | | 50.00 |
| 160 ft. 12-inch cast iron pipe | @ | 2.25 | 360.00 |
| 40 ft. 18-inch cast iron pipe | @ | 4.00 | 160.00 |
| 380 ft. 36-inch cast iron pipe | @ | 8.00 | 3,040.00 |
| 28,000 lbs. cast iron specials | @ | 0.05 | 1,400.00 |
| 5 12-inch valves (gate valves) | @ | 10.00 | 150.00 |
| 6 18-inch pressure equalizing valves | @ | 12.00 | 72.00 |
| 1 24-inch tidal valve | @ | 18.00 | 18.00 |
| 485 ft. 1½-inch pipe railing | @ | 0.60 | 291.00 |
| Superstructure for valve chamber | | | 500.00 |
| 1,000 lbs. wrought iron and steel | @ | 0.05 | 50.00 |
| 300 ft. ¾-inch galv. wrought iron pipe | @ | 0.v0 | 90.00 |
| Total | | | $44,805.50 |

# EDITORIAL COMMENT

## THE AUTOMOBILE IN MUNICIPAL SERVICE.

Within the past three or four years there has been an enormous advance in the application of the gasoline engine to the service of municipal departments in moving vehicles and in supplying power for other purposes.

Perhaps the earliest use of the automobile was in the police department, where speed is an important factor in keeping the department abreast with the law-breakers, and stock cars and patrol wagons have been used for several years.

Then the fire departments recognized the value of speed and control, and, not much more than three years ago, began to supply automobile hose and chemical wagons, followed by squad wagons and engines, the latter being equipped with gasoline engines for pumping, or using the same engines for motive power for both machine and pump. The development has been rapid and some wonderful results have been obtained, but the best has not yet been reached, and the improvement in the next few years will be still more marked than in the last three.

The park departments are just beginning to use gasoline power for running park engines, for spraying trees, for cutting grass and rolling lawns and for the numerous other special operations peculiar to their work.

We have in this number, by courtesy of City Engineer R. H. McCormick, of Detroit, Mich., a photograph of what is said to be the first automobile designed and purchased for the special work of a city engineer's department, which has been in use since 1907. This shows very nearly the limit of the use of the automobile in special city use, altho, doubtless, stock machines of various sorts have been in use for a longer period of time in this and other cities in one or more of the departments. It would be of interest to record the first purchase of an automobile for use in any city department, and our readers are invited to give the details of any such purchase and use coming under their observation or experience prior to 1907.

Mr. McCormick's department now has four automobiles in use, the department of public works has a few more, the police department has seventeen automobile vehicles and sixteen motorcycles, all purchased since 1909; the fire department has about twenty-five automobiles of all sorts, from the runabouts to fire pumping engines, all purchased since 1909, and most of them in 1911 and 1912, and the park department is supplying itself, including a number of new park wagons for making the rounds of Belle Isle park. And all this seems to the investigator to be but a small beginning of the development which is now imperatively demanded.

If this is true of a first-class city, like Detroit, it is still more true of the cities of the United States in general. This fact has so impressed itself upon MUNICIPAL ENGINEERING, that this magazine has decided to pay such special attention to the subject as its growing importance demands. This has been shown by the articles in recent numbers, and will be shown still more strongly by the October number, in which a special effort will be made to record the present state of the use of the automobile for municipal purposes and to show the basis upon which

future growth must rest. It is the intention to continue in future numbers the practical treatment of the automobile in city use in the same way that this magazine is accustomed to treat municipal problems. The question department is open to all our readers for their use for all problems from carbureter troubles to design of machines for special purposes, and the questions will be answered by experts in the practical use and construction and design of machines. Practical articles on subjects all along the line will also appear at frequent intervals and will cover all the subjects touched upon by our correspondents, and such others as seem desirable.

We trust that our readers will make the same use of the department for these purposes that we are glad to see them make for others in the municipal field, and that they will also report their own experiences and ideas in articles for the department, "From Workers in the Field."

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## MAKING AND CORRECTING CITY PLANS.

Much of the earlier work in "City Planning" and on the "City Beautiful" was in the way of civic centers and connecting boulevards, which necessarily concentrated the effort upon certain points or lines in the city, leaving the improvement of the rest of the city to local effort or neglecting it altogether. There has been a commendable tendency on the part of the landscape architects and engineers and advisers upon municipal beauty to extend the work over larger areas, and many of the reports of such men as Robinson and Nolen upon the improvement of the smaller cities have recommended plans which would leave no part of the city out of consideration.

One of the principal difficulties in the way of control of city development has been the power which the individual land owner has in most states of laying out his land according to his own ideas and without reference to the conditions in the surrounding territory, the convenience of travel along the streets or the appearance of streets or buildings. This difficulty with reference to Boston and its environs was discussed in a paper by Arthur A. Shurtleff, a landscape architect in Boston, before the last conference on city planning.

Mr. Shurtleff shows clearly that, so far as main lines of communication are concerned, the demands of the surrounding country and of communication with other towns in the days before railroads produced a system of roads which is almost ideal so far as radial roads are concerned, and that all sections of the city and its suburban towns can be reached with the utmost ease from the center of the city. This will be found true of many towns and cities which have developed in accordance with the demands of the times, but is not true of that large number of cities which have been laid out with large ideas of their probable future growth. Nor is it true of cities in the western districts laid off in square miles under the system of the U. S. Land Survey, which system has been followed in the details of alleys and streets in cities laid out upon those square miles, even to the extent of showing the jogs upon township lines which were provided for in the original system to correct the errors which crept unavoidably into the surveying work in the wilderness in which it was originally done.

In the states, especially the level states, under the U. S. Land Survey system, the section and half-section lines are adopted as lines of roads and there are few roads in any other locations, and a city laid out complete or allowed to develop follows the rectangular system unless some interested person forces a modification. The rectangular system is therefore the natural outgrowth of the conditions in all states from Ohio west, with a few exceptions, owing to early settlement by French or Spanish, such as Detroit, New Orleans, parts of St. Louis, and the older parts of some Pacific coast cities.

Mr. Shurtleff next points out the tendency in Boston and its suburbs toward circular roads across town, with the center of the city as a common center, and shows the nature of this tendency by a plat showing only these cross-town roads or main streets. He suggests that, so far

as the suburban towns are concerned, and therefore the foci in the outer districts of the city as the suburban towns are absorbed into it, this tendency toward circular cross-town roads is due to the development of main roads with some reference to topography between contiguous towns, thus making lines of communication between these towns, which are independent of the lines to the center of the city.

These, again, developed in the days of horse-drawn vehicles, and cities which have developed since the railroad era do not have, nor have they heretofore required, many of these main cross-town routes. Indeed, the modern suburban town or neighborhood center develops as a residence and correlative small-business center for those doing business in the city, and there has been, comparatively, but little necessary communication between these suburban towns or neighborhood centers, and cross-town traffic is therefore small and unimportant. Where the rectangular system prevails, and it has developed mainly within the same period of time as the railroads, this unimportance of cross-town communication is still more pronounced, and there are many cities of several hundred thousand population in which it is necessary to take a car to the center of the city and then out on another line to reach centers just out of walking distance across town. These are developments of the railroad and street-railroad era and are natural. No city planning campaign could have had more than a superficial effect upon them.

Mr. Shurtleff then shows that these cross-town streets are not continuous, and shows that the reason for the numerous breaks in them is to be found in the fact that each part of such a street is the line of communication between two such centers, without reference to any other one. Therefore, in many of these centers there is a failure of direct connection which amounts to anything from a few feet to several blocks. He finds that many of the breaks in cross-town streets are due to the private control of the platting of land to the extent that streets in one plat are laid out with no reference to streets in another, and as the ideas of one man as to the way of getting the most out of the sale of lots do not agree with those of another, there are as many sizes of lots and widths of streets as these ideas and the irregular boundaries of the properties of their possessors can produce. The only limits to such a wilderness are the old-time roads between these centers, located when the area was farming land and there was no idea of making it into city lots.

The same objectionable effect of control of plats by the private owners is seen in the cities laid out on the rectangular plan, but the controlling lines are more regular, the plat having a road in each rectangular direction at least every mile, and probably every half mile, so that there are roads of reasonable regularity and continuity each half mile.

Mr. Shurtleff complains of this, and thinks control of these plats should be assumed by the city. This same complaint was made in Indianapolis some thirty years ago, and the legislature passed a law requiring the approval of plats within three miles of the city limits by the board of public works before they could be recorded. This law has been in effect for more than twenty years, and is having a good effect. But before it was passed much damage was done, and one can now see the boundaries between the original square mile, laid out on a liberal scale, an area of smaller lots and narrower streets, presumably because cheaper lots were demanded, areas laid out on much more liberal plans, a second strip of small lots with interpolated streets, each band being broken up into sections of each sort, and each band being a half mile in width.

If these rectangular cities had developed at the same time that Boston did, it is probable that the diagonal streets would have developed also, but they did not come to any considerable size until street railroads had reduced the difficulty of getting down town and the time required. As a consequence, the desirability of lines leading more directly to the center was not so strongly emphasized and the natural tendencies based on the controlling influences of the rectangular

property lines have continued to have their full effect.

A new factor has entered the problem and it remains to be seen what its effect will be. The automobile has entirely changed, for a time at least, the character of travel, much of it being for pleasure rather than direct business. While the use of the automobile for business purposes is increasing rapidly, it is probable that its use for purposes of pleasure riding will always be great in proportion to its use for other purposes. This means a material increase in cross-town travel at certain times of day in particular, and emphasizes the need of continuous cross-town streets. The Boston case can hardly be made satisfactory without considerable reconstruction, but the case in the rectangular city is different. The occurrence of fairly continuous cross-town streets every mile, if not every half mile, makes it possible to get across at almost any desired point. The greater speed of the automobile and its capacity for continuous motion without "cruelty to animals" makes the few yards greater travel to get round the rectangular blocks unimportant, so that the need of secondary diagonal streets between the secondary centers, such as contiguous suburban towns, is not very serious, so that even the much heavier travel is not likely to demand great expenditures for easier methods of communication, except possibly under such circumstances as Mr. Shurtleff describes, or such as exist in Memphis, Tenn. That city is located with its front on the Mississippi river, and is well provided with streets running back from the river in continuous and approximately straight lines to the city limits, but it has practically but one street, and that very near the river bank, which extends across town in a continuous line, straight or otherwise. This is a city laid out on the parallel rather than the rectangular or the radial plan, and so has problems of its own, of which this suggestion is sufficient at this time.

One of the principal developments of the agitation for improvement of civic beauty is the planning of boulevards to connect parks with each other and with the various civic centers. So far as pleasure traffic is concerned, and this will include much business travel in automobiles, these connecting boulevards would serve very well as cross-town means of communication, and it is probable that the desired results upon this line can be obtained more quickly and easily by promoting these boulevards, and perhaps extending them to some extent, than in any other way.

The writer is heartily in favor of such civic center developments as are foreshadowed in the leading article this month for Chicago, and as are under construction in Cleveland, but much of the practical value of civic improvements, so far as the individual citizen is concerned, is to be obtained by the less expensive and more readily constructed works of less extent, such as small parks and connecting boulevards, and his only desire is that these less striking, but more generally useful improvements, shall not be forgotten, but shall be promoted at the same time, that they may be secured and enjoyed during the long years necessary for the development of the grander plans.

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## INCOME FROM MUNICIPAL AND COMMERCIAL SERVICES BY PUBLIC SERVICE PLANTS.

One of the difficulties in making appraisals of public service plants for purposes of making rates is in distributing the total of charges against income between municipal and commercial services, so that the charges for municipal lighting may be equitable as compared with the service rendered and with the charges for service to other customers, whether large or small consumers. This consideration is of particular value in municipally owned plants, although it is almost wholly neglected in most of them.

So far as capital charges are concerned, engineers are coming to a fairly general agreement as to the methods of determining the value of municipal service from water works plants, which have been principally in mind in writing the preceding articles in this series, but there is much less uniformity in opinions regarding the relative value of municipal and commercial services in the case of

electric lighting. This is exemplified in the recent Worcester, Mass., case, in which the rate for magnetite street lamps was fixed by the State Board of Gas and Electric Light Commissioners.

Confining the discussion to the capital charges as nearly as may be, leaving those depending on operating conditions to another time, the following comparisons of the contentions of the two parties to the case and the decision of the board may be made:

The city's expert estimates the investment of the company for its street arc lamps at $300,000 and allows 5 per cent. interest and 7 per cent. depreciation upon this amount.

The company proposes to make up the investment for street lamp service of the following items: (1) The investment in both old and new generating stations and their connecting lines is to be divided in the ratio of the municipal arc connected load to the generating capacity of the new station; (2) the station equipment used exclusively for the municipal arc lighting system; (3) the municipal arc lamps, posts, wires and fixtures; (4) underground cable for municipal arc circuits; (5) ducts used in municipal arc circuits; amounting, in all, to $403,976. On this amount the company proposes to allow 6 per cent. interest, and 5 per cent. depreciation on $397,515, which omits value of land.

The commission refused to accept either method as conclusive, since it is impossible to separate the municipal arc system absolutely from the plant as a whole. Thus it considers that all of the $48,000 added to the share of the municipal arc system in the investment in the new power house, according to the company's method of computation, is not properly chargeable to that system. The reason given for this position is that the city's service was well taken care of in the old station and the new station was demanded by the material increase in the demands for commercial service, particularly for power service, and that service should carry the additional investment charge. This is decided notwithstanding the fact that the municipal arc system's proportion of the value of the power plants amounts to less than the estimated cost of a new independent plant for that system alone. This would seem to be a good place to apply the principle discussed in the article on "Obsolescence and Decrepitude as Factors in Depreciation," on page 100 of the August number. The board has arrived at a similar result, though very indefinitely stated, but if proper consideration were given to the influence of the improved station upon net returns and the increase in investment allowed were fixed in relation thereto, with due attention to the municipal and commercial branches of the business, a definite figure could have been fixed.

The second, third and fourth items of the company's inventory of the municipal arc system are readily determined, and there is little or no opportunity for difference of opinion concerning them.

The company makes a larger claim regarding the proportion of the value of the underground conduit system than the board is willing to allow. The contract requiring the construction of the conduits provided for one duct for free city use in each circuit. The company made a complicated augmentation and correction of the estimated value of the ducts occupied by municipal arc cables by means of the ratios of the municipal arc ducts to all ducts except the free city ducts, of the vacant ducts to all ducts except the free city ducts, and of municipal arc ducts to all ducts actually occupied, but the board limits the computation as nearly as the circumstances permit to the ratio of ducts occupied by municipal arc cables to the total number of fully occupied ducts, the unoccupied ducts having been laid to provide for the expansion of commercial business, with little expectation of the necessity for future additional ducts for municipal arc service, but rather an expectation that some of the space in ducts carrying municipal arc cables would be occupied also by commercial cables as business developed.

This last computation is getting deeper into detail of distribution than these articles were intended to reach, but it serves to show the desirability of discussion of such matters that standards may be developed intelligently and applied with some uniformity.

The board decides that it is impracticable under present conditions to make an analysis and apportionment of the company's property and operations so accurate and conclusive as to be a controlling factor in fixing the price for municipal arcs, and proceeds to fix the price largely upon other considerations at $80.30 per lamp per year, which is $11 less than the previously prevailing price and $15 more than the city fixed as an equitable charge. More than half the price is required to meet interest and depreciation charges, so that the value of accuracy in determining the investment is clearly shown.

The general agreement upon methods of taking care of such special technical questions in the water field as hydrant rental has been brought about by discussion and careful study of details. This question of price of municipal arc lights is one which is analogous in the electric lighting field, and, while somewhat more complicated, is capable of almost as complete formulation and consequently of approach to general agreement upon methods.

## CIVIC BEAUTY.

Attention is called to the department, "Civic Beauty," on following pages of this number, which is a concentration under one heading of the efforts of MUNICIPAL ENGINEERING in this direction. American cities are rapidly passing the strictly utilitarian stage; in fact, many of them have passed it, in the sense that they now fully recognize the value of civic beauty. That beauty and utility can go hand in hand and that a city can be built in a pleasing way at as little cost as otherwise has been demonstrated many times. That heavy cost is a profitable investment has been proved by a few prominent examples. Between them they cover almost the entire field of city building.

For many years this magazine has been identified with movements tending towards the uplift of municipalities in America, and has by means of its efforts had much to do with the upward trend of city management, which has been so markedly shown by the improvement in the personnel of city administrators, the increased interest which is being continually shown by the average citizen, in the more systematic and business-like methods pertaining to city government and a general approach toward producing better, cleaner, more healthy and more useful cities.

City embellishment is generally conceded to be necessarily an after thought, a luxury only to be afforded by a city after its utilitarian departments have been fully provided for. American people have been prone to suffer their cities to grow in a hap-hazard fashion, providing no general plan for their development and paying scarcely any heed to the aesthetic problems which have been so carefully considered by city builders of other countries.

That the American municipality, especially the smaller, growing city, may be greatly benefited by considering matters of civic beauty and especially by securing, as early in its history as possible, a comprehensive, well-balanced and dignified plan or program of development, is one of the objects for which this department will strive.

We feel that municipal officials will read with interest the articles which will appear in the department from time to time. They will be written by well-known authorities and upon the most practical and timely subjects in this field. A well-known park builder, Mr. Myron H. West, of Chicago, will pay special attention to this department, which will be a guaranty of its quality and efficiency.

## OUR NEW COVER.

The most striking improvement thus far made by the new management of MUNICIPAL ENGINEERING is undoubtedly the new cover which is first used this month. It illustrates the new department, "Civic Beauty," and we believe it meets the demands of the artist as well as being a good photograph. It is the intention to illustrate, each month on the cover, one of the most prominent features in the issue, and experience will undoubtedly enable us to improve upon the high standard set by this first design.

# THE QUESTION DEPARTMENT

**Oxidation, Sterilization and Disinfection of Sewage.**

Please explain the difference between oxidation, sterilization and disinfection, as applied to sewage and sewer effluents.

S. E., ——, Okla.

Oxidation in a sewage effluent means the same as elsewhere, viz., the combination of oxygen from whatever source with the carbon, hydrogen, nitrogen, sulphur, etc., in the organic matter suspended or dissolved in the water. Oxidation is a chemical process which may be the result of the action of chemical or of biological forces.

Sterilization and disinfection are terms which mean the same thing, so far as the removal of the danger of infection is concerned. Disinfection is the older term as applied to sewage and other possible sources of infectious diseases, and the term is still applied to the application of chemicals by the older methods, in the attempt to remove the danger. Sterilization is the newer term and means, as ordinarily used, the destruction of all life in the liquid, whatever method may be used. The bacteria causing disease being less hardy than many others present in the sewage, disinfection should mean the destruction of such dangerous bacteria and may mean simply the stoppage or the delaying of the action of the other bacteria, whereas sterilization, if as complete as the term indicates, means the destruction of all life, and no new organic action can take place until inoculation with bacteria or other life from the air or other sources thereof. The distinction between the two terms is not definite, and this explanation is an attempt to express the common opinion regarding their difference in use. The distinction made in the dictionaries between the words for general use is on the same line, disinfection meaning the removal of infectious organisms and sterilization meaning complete removal of power of reproduction in any form.

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**Size of Water Mains and Leakage Therefrom.**

Can you tell us where we could get the following information?

What size cast iron water pipe would it be advisable to use for a main line for a water works to supply 40,000 to 50,000 gallons per day, raising the water 500 feet in pumping from 8,000 to 9,000 feet?

What power gas engine pump would be necessary to handle the above requirements, and how many thousand feet of gas per day would it require?

Also, could you mention two or three manufacturers of gas engine pumps who are in position to furnish such machinery?

Could you give any information as to how a water company should proceed to locate leaks on the main line, where there seems to be large waste but the water does not rise to the surface anywhere near the line?

T., ——, Pa.

All the factors required to be known in order to answer the first question properly are not given. They are all fully discussed in Turneaure and Russell's "Public Water Supplies" ($5). A diagram given in the book indicates that under the ordinary conditions of domestic water supply without fire service a three-inch pipe will be sufficient to carry the amount required. An engine of 20 brake horsepower capacity would lift the water readily.

There are a number of books on the gas engine which will give more or less information regarding the kind of engine to choose for pumping, such as Audel's "Gas Engine Manual" ($2); Donkin's "Gas, Oil and Air Engines" ($4); Hutton's "The Gas Engine" ($5); Jones' "The Gas Engine" ($4).

Manufacturers of gas engines and pumps are the Quincy Engine Co., Quincy, Pa.; Harold L. Bond Co., 383 M Atlantic avenue, Boston, Mass.; Goulds Mfg. Co., 131 W. Fall street, Seneca Falls, N. Y.; Harris Air Pump Co., Indianapolis, Ind.; Keystone Pump and Drill Co., Beaver Falls, Pa.; Leiman Bros., 62 Al John street, New York City; Merritt & Co., 117 N. Front street, Camden, N. J.; Practical Gas Engine and Machine Works, North Chicago, Ill. Reference may be made to the "Business Directory" published in each number of MUNICIPAL ENGINEERING under the headings, "Engines," "Gasoline Engines," "Pumping Engines," "Pumps," "Sewage Pumps," "Sewage Lifts."

Several articles on methods of finding leaks in water mains have been published in MUNICIPAL ENGINEERING. Among those of interest in this connection, some giving references to other sources of information, also, are the following:

In vol. xliii: "Testing Water Pipes by Compressed Air," p. 42; "The Cost of Leaks

in Water Works Distribution Systems," p. 20; "Methods and Cost of a Leakage Survey for Lancaster (Pa.) Water Works, p. 31.

"Apparatus for Finding Leaks in Water Pipes," vol. xl, p. 429. "How to Find Leaks in Water Mains," vol. xxxix, p. 390. "What Is an Aquaphone," vol xxxvii, p. 329; "Measuring Water Waste," p. 257. "How to Find Leakage in Water Mains," vol. xxxvi, p. 319. "Location of Leaks in Water Mains," vol. xxxvi, p. 108.

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**Can City Plant Supply Water Outside.**

Can you inform me whether or not a city, owning its own water works, can enter into contract and supply water to an association outside its corporation limits? What jurisdiction has it over the pipes and meters laid outside of its corporate limits?

F., City Attorney,
———, Iowa.

This is a question which must be answered according to the constitution and laws of the state in which it arises. Following are some decisions quoted in MUNICIPAL ENGINEERING and articles containing other information bearing on the subject:

The discussion in vol. xlii, p. 391, may be of interest.

According to the case of Steitenroth v. City of Jackson, a Mississippi city cannot supply water to citizens living outside the municipality, vol. xli, p. 140. By Edwards v. City of Cheyenne, Wyoming cities can condemn land outside city limits for water works purposes, and this is universally true, and carries with it control of the pipes and appurtenances laid in connection therewith, vol. xli, p. 141. According to Childs v. City of Columbia, that South Carolina city can supply water, under ordinances governing the case, to persons living outside the city limits and can terminate its agreements thereunder on thirty days' notice, vol. xli, p. 141. According to a case stated in some detail in vol. xli, p. 142, Reading, Pa., was adjudged unable to sell water to consumers outside its own boundaries, the matter having been so decided after presentation to the courts in several different forms.

According to Somerville Water Co. v. Borough of Somerville, a New Jersey water company can serve consumers outside the city from which it receives its powers, but this decision does not cover the case of a municipally owned plant; vol. xl, p. 440.

One of the questions in the Omaha water works case was as to the transfer to the city of Omaha of the portion of the plant serving South Omaha, but it seems to have been decided that the city must take the whole plant and operate it for the city of South Omaha as well as for itself; vol. xxxix, pp. 48, 300; vol. xxxvi, p. 45.

Texas has a law prohibiting cities from selling water to consumers outside the city limits, unless they are factories, which is declared valid in Sturgeon v. City of Paris, vol. xxxviii, p. 353.

The method of testing the right of a water company to sell water for use outside the municipality is stated in Bland v. Tipton Water Co., a Pennsylvania case, reported in vol. xxxvi, p. 322.

A decision that a private water company, operating outside of Rochester, N. Y., but with a pipe line in the city, could not sell water in the city, which has a municipal plant, is quoted in vol. xxxi, p. 29.

Other decisions quoted in earlier numbers are equally irregular, owing mainly to the local legislative and constitutional peculiarities. The writer knows of no Iowa decision on the subject. Can our readers give any additional information?

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**Waterproofing Concrete Pit.**

We wish you would advise us whether you can suggest any method of waterproofing from the inside a concrete pit, 22 feet square on the inside, about 17 feet deep, where the outside water level is about 15 feet above the bottom.

There is a seepage of approximately ½ foot per day in this pit, and apparently the water comes in from the sides for a distance of about 2 feet above the bottom. It appears that the bottom of the pit is practically watertight.

The ground conditions are such that the method of tarring or otherwise waterproofing from the outside is not warranted because of the prohibitive expense.

C., ———, N. Y.

Will our readers report any methods which they have found efficacious?

Perfect success seems to be dependent almost entirely upon good workmanship. The pressure per square inch on the bottom of the pit on the outside is about 6½ pounds and, while this is not sufficient to force water through the concrete at a rapid rate, the attempt to stop the seepage of water will cause this pressure to develop sufficiently to make it difficult to force any waterproofing material into the pores through which the water is seeping or to keep intact any waterproof coating which may be put on the inner surface of the pit. One practical waterproofing expert says:

The only possibility of opposing a reasonably effective stop to the water by an inside application lies in making it of ample thickness and bonding it effectually to the existing concrete. Waterproofing cement in various forms has been tried under these conditions. In one of the most successful forms it combines with the good qualities of a first class Portland cement the power of expelling water. It is usually applied in a coating about 5/8 inch thick, but requires a special sand for its mixing and especially skilled labor in its manipulation. Its success depends primarily upon its adherence to the wall.

Shrinkage cracks, if they occur, reduce its value by the leakage which may occur thru them.

One manufacturer of a special waterproofing compound recommends the following specification:

Water-tightness shall be secured by plastering the inner surface of damp walls and floor with an unbroken continuous coat of cement mortar to which Trus-Con waterproofing paste has been added.

The waterproofing cement mortar shall be prepared by thoroughly tempering, to required consistency, a dry mixture of one (1) part of cement and two (2) parts of sand with water to which Trus-Con waterproofing paste has been added in the proportion of one (1) part of paste to twelve (12) parts of water. The sand shall be clean and spherical and well graded from coarse to fine.

Before plastering cement mortar on old concrete, the surface of same shall be treated as indicated in the following:

(a) The old surface shall be cleaned very thoroly with a heavy wire broom so as to remove all dust and dirt. A jet of steam shall be employed to clean the wall, if available.

(b) To the mechanically cleaned surface, apply with a large brush a liberal coat of 1:10 solution of hydrochloric acid. Allow the acid to remain until it has exhausted itself, which will require at least ten minutes. A second liberal coat of acid solution shall be applied before removing the first. A third coat shall be applied if the two applications have not satisfactorily exposed the aggregate and entirely removed the skin of hardened cement.

(c) With a hose under good pressure, slush the surface in one direction so as to remove the salts resulting from the action of the acid. Continue the slushing until the salts and all loose particles are removed and the old concrete is thoroly soaked to its full hygrometric capacity.

(d) To the cleaned and saturated surface, apply with a strong fibre brush a coating of pure cement, mixed to the consistency of thick cream, with water to which Trus-Con waterproofing paste has been added in the proportion of one (1) of paste to twelve (12) of water. Rub in vigorously so as to fill all the crevices and cavities produced by the action of the acid.

Immediately after applying the above slush coat, the first coating of waterproof cement mortar shall be applied (thickness ⅜ inch) directly upon the slush coating and well trowelled into every void or crevice of the surface. Before this first coat has reached its final set a second and final coat shall be applied to an equal thickness, so as to make the full average thickness ¾ of an inch. The finish coat shall be floated to an even surface and subsequently trowelled free from any porous imperfections. If the conditions of the work make it impracticable to apply finishing coat before scratch coat has set, the latter must be dampened and slush coated before finishing coat is applied.

The floors shall be treated and prepared exactly as indicated above and finished with the waterproofed mortar to a thickness of two (2) inches. Special care shall be exercised to bond the wall coating to the floor coating, so as to make the waterproof coat absolutely continuous.

Another method, for use where the water pressure is great and the seepage is considerable, is recommended by a manufacturer of a special waterproofing material, as follows:

Where there is pressure the first object should be to temporarily relieve the pressure on the surface to be treated, if possible. If the surface to be treated is a floor, one or several small wells should be made, reaching from one to two feet below the surface of the floor, and provision should be made for keeping the water pumped or bailed out of these wells constantly until the treatment of the floor is finished. Where the surface to be treated is a wall, holes should be drilled into the wall at convenient intervals. In each of these holes should be inserted a collapsible tin tube, such as may be bought at most confection or school stores under the name of "bean blower." The seams of these tubes are not soldered and when firmly inserted into the wall may be caused to collapse by twisting them in the proper direction. After such a tube is inserted into a hole (which should be ordinarily from one and a half to two inches deep) dry cement should be placed around the tube and tightly packed into the hole so as to hold the tube in an inclined position, with the free end pointing slightly downward so that the water will run thru the tube and drip off at the end. The seam of the tube should always be on the upper side, as otherwise the water is liable to work thru the seam and wash the underlying cement away before it has had time to set. The number of bleeders to be inserted into a given wall depends entirely on the amount of water to be drained off and the condition of the wall. Quite often it may be necessary to place tubes less than a foot apart. After drainage has thus been provided the wall should be proceeded with under proper Ironite process according to condition. The drains and wells should be left undisturbed until the Ironite has sufficiently developed to make the surface substantially waterproof. After this is accomplished (which ordinarily will take a couple of days) the wells should be filled with a good concrete up to within three inches of the surface and the remainder finished with a rich mixture of pure cement and torpedo sand, to which should be added about 15 to 20 per cent of Ironite. A better bond for topping of "well" may be obtained by coating upper edges of well with Ironite. This mixture should be tamped down hard and thoroly bound to the surrounding edges, and where there is considerable pressure a smooth board with a heavy weight should be placed on top of it at least two or three days and left in that condition undisturbed. After this period, if there should be any leaks, they should be filled with cement mixed with Ironite, which should be thoroly tamped down and driven into all cavities, and rubbed into the leaking surface. The wall drains require a similar treatment. When the surrounding surfaces appear to be waterproof, the tubes should be withdrawn by twisting them around their own axis so as to collapse them; then a piece of cork or similar substance should be driven to a depth of an inch and a half into the hole left by the tube, and immediately after that the remainder of the hole should be filled with a mixture of pure cement and Ironite in equal parts. This mixture should be put into the hole in a dry form in case there is leakage around the cork; otherwise it may be used in the form of a very thick paste. In case the Ironite is applied in a dry form, it should be thoroly packed and tamped in. This can be done without displacing the cork, on account of the peculiar packing qualities of dry Ironite, which will set as fast as it takes up the moisture and will not permit itself to be displaced. Wet Ironite will slip and will be much more readily washed away than dry Ironite working in this manner. After the holes are filled, they should be trowelled smooth so as to correspond with the surrounding surface, and thereafter the surface should be watched for several days for any leaks which might appear. Any such leaks should be treated with dry Ironite substantially as above described in reference to floor leaks. Not infrequently a persistent leakage will occur in certain places tho they have been treated properly. In such cases a careful investigation and sounding will usually reveal a rotten and partially hollow place in the wall. A pointed instrument should be driven into the wall in such case and all loose particles should be thoroly removed and the resulting cavity, if small, should be filled with dry

Ironite to be driven in and tamped hard as above described. In case the cavity discovered is large, the rear portion of it may be filled with a mixture similar to that used in the case of a well in the floor (described above).

Where water pressure, in a basement for example, is stopped, it has been found that an increased pressure is thrown on the angles (especially those between the floors and walls). It is often advisable to reinforce these angles by trowelling in a "filler," composed of cement, torpedo sand and about 10 per cent of Ironite; thereby slightly rounding said angles.

Other materials of like nature or even portland cement without the special waterproofing can be used in either of these specifications, with probability of success if the workmanship is of the best. None of them will be successful if the work is carelessly done.

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**How to Raise Money for Public Improvements.**

We contemplate installing electric lighting and water works for our city. We will have to issue bonds to the amount of thirty or thirty-five thousand dollars, and our assessed valuation is $660,000. What is the best way to proceed? We are out of debt, and have seven thousand dollars on hand.

S., Mayor, ———, Ind.

The first step should be to have complete plans and detailed estimates of the cost of the lighting and water works prepared by a competent engineer. This will show how much money must be raised, and will save the city money in many ways besides giving a definite sum to discuss in deciding whether the city shall build the works or not.

The mayor and council can then estimate the amount of money which will be available from the funds of the city, including that on hand and the probable surplus for the following year or two. They can then decide how much of the remainder of the cost of the works shall be raised by increasing the tax rate and how much must be raised by selling bonds. It is probable that some money must be raised in each way, the bonding limit being possibly not high enough to build the works entirely from the proceeds of the bonds.

An ordinance can then be passed authorizing the issue and sale of the bonds. Ordinances should be passed from time to time appropriating the money raised in the ways mentioned to pay for the works as needed, or a single appropriation ordinance can be passed after the bond issue has been made and all the money is on hand.

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**Ordinances Governing Building Construction and Storage of Explosives and Combustibles.**

If you have anything modern and up to date on building regulations, and the sale and storage of high explosives, gasolene, etc., I would be pleased to see them.

S., City Attorney, ———, Pa.

The most modern form of building ordinance is probably that passed by the city of Cleveland, O., which fills a good-sized book. Chapter XVIII of the ordinances providing governmental and general regulations covers the subjects of combustibles, explosives and fire arms very completely, occupying 15 pages and divided into 36 sections. The building code is printed separately and doubtless the city attorney would supply a full copy of the ordinances on request from the city attorney of a sister city.

Ordinances concerning fireworks and the like will be found in MUNICIPAL ENGINEERING, vol. xl, p. 209.

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**Form of Gas Franchise.**

We now have an application for a gas franchise, and if you would be so kind as to send me what you consider a good franchise I will greatly appreciate it. If you are in a position to give me the information I would like you to state whether it is possible for the city to insert a clause in the franchise requiring the deposit of a certified check to be forfeited in case the system is not built. S., City Attorney, ——, Wis.

A modern franchise for a gas company in a small city will be found in vol. xlii, p. 185.

Some German franchise provisions are given in "Gas Lighting Franchise in Hanover, Germany," vol. xlii, p. 471.

Some of the provisions quoted in the article "Bill to Control Gas Companies in the District of Columbia," vol. xxxix, p. 51, will be found of value. The article on "Determining Minimum Charge for Gas," in vol. xxxix, p. 222, may give some suggestions that can be used. Some of the information given in "Information About Gas Manufacture," vol. xxxix, p. 389, will be of interest in the consideration. A list of books and articles giving "Information About Franchises for Public Utility Corporations" will be found in vol. xxxix, p. 473. The "Influence of Indeterminate Franchises on the Value of Bonds of Public Service Corporations" is discussed in vol. xl, p. 46. A decision affirming the right to tax gas mains is quoted in vol. xl, p. 138. A series of articles giving brief description of gas processes and tables of rates in many small cities will be found in vol. xl, pp. 38, 125, 220, 347.

Some articles on franchises for other public utilities will be of interest in this connection, such as "Street Railway Franchises," vol. xlii, p. 188; Specifications for Electric Lighting Contract," and Electric Light Franchise," vol. xl, p. 37; "Best Form of Water Works Franchise," vol. xxxix, p. 35.

As to the question of the deposit of a certified check as guaranty that the works will be built, it would seem to be quite as proper and legal as the filing of a bond to the same effect. A bond to secure the completion and beginning of operation of a gas works within a definite period of time is, if properly made, liquidated damages for the failure to carry out the contract and the same can be collected by suit against the bondsmen in

case of failure. The certified check is similar in effect and the contract could be worded in such a way that the check could be collected in case of failure to fulfill the requirements, subject, of course to suit for injunction or recovery in case the company wished to test the correctness of the city's decision that the contract had not been fulfilled. There may be some Wisconsin statute which governs the matter. See MUNICIPAL ENGINEERING, vol. xliii, p. 49, for statement of decision in Grayson v. City of Marshall, Tex., on the point mentioned above.

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**Ordinance Providing for Municipal Court Juries.**

Have you any ordinances or charter amendments providing for city or municipal ordinances for courts with juries to try cases therein? J. L. M., City Attorney, ———, Ga.

The writer knows of no such provisions in city charters or city ordinances. Under the principle that a city can do only what its charter permits, no city could establish jury trials in its city court unless they were provided for expressly in its charter. The writer knows of no city which has such an institution unless it is coextensive with the county in which it is located. If our readers know of any such will they refer our correspondent to them through this department?

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**Ordinances Regulating Peddling and Taxing Amusement Resorts.**

Please give an ordinance for peddling in boroughs; also taxing places of amusement. S., City Attorney, ———, Pa.

An ordinance governing peddling in a Pennsylvania boro is not at hand. The following are the provisions of an ordinance which has been in successful operation for some years:

Sec. 1. Makes its unlawful to peddle without license, provides for more than one license to the same individual, and requires as many licenses as he has persons employed in peddling. Defines peddling as follows:

Every person who goes from house to house or from one part of the public streets to another in a vehicle, on foot or with a push cart, offering for sale any goods, wares, merchandise, fruit, candies, poultry, produce or other article, shall be deemed a peddler within the meaning of this ordinance, and the word peddler shall include hucksters, "hawkers" and "intinerant dealers" as commonly used, and shall include also any person going about said city on foot or otherwise, taking orders for or selling any kind of goods, wares or merchandise, by sample, to be afterward delivered. Provided, however, that nothing herein shall be construed to apply to drummers selling goods by sample to resident merchants. Provided, further, that non-residents peddling linen, laces, rugs or dry goods, by sample or otherwise, shall pay a license of 50 cents a day.

Sec. 2. Provides for 6 months and one year licenses at the rate per year of $20 for peddlers using any wagon, cart or other vehicle, and $6 for all others, licenses to date from January 1 and July 1 with no reduction for parts of the half year.

Sec. 3. Exempts from the provisions of the ordinance persons selling produce of their own raising or newspapers and children under 15 selling fruit, matches or stationery.

The city clerk is authorized to charge $1 for issuing each license.

Violators of the ordinance may be fined not exceeding $25 and licenses may also be forfeited.

Another ordinance prohibits peddling between 7 a. m. and 6 p. m. on penalty of $5 fine.

Following are provisions for license taxes for general revenue purposes on places of amusement, which are selected from a general ordinance covering all licenses in a Pennsylvania city:

1. There shall be levied, collected and paid within the city of —— for general revenue purposes, a license tax; and every person, firm or corporation hereinafter mentioned, shall, on or before the first day of June of each and every year, apply to the city treasurer for a license, which shall expire on the 31st day of March following, and the license year shall begin on the first day of April of each year, and include 12 calendar months, and the city treasurer shall issue such license upon payment to him of the respective sums for the same, as provided for in this ordinance: Provided, that all persons, firms or corporations commencing business after the first day of June shall pay a pro rata of the whole year, and that all licenses shall begin on the first day of the month.

2. The amount to be paid to the city treasurer shall be as follows:

xxvii. Every company, firm or individual owners of an opera house or other hall open for public amusement with a capacity to seat 1,000 persons or upwards, shall pay annually the sum of $100.

xxviii. Having a capacity to seat 500 or upwards, not exceeding 1,000, shall pay annually the sum of $75.

xxix. Owners of all other places of amusement shall pay annually the sum of $50.

xxx. Theatrical companies, minstrel shows or variety troupes giving public entertainments in the city shall pay for each entertainment $5; Provided, that if the entertainment is given by a company organized for encouragement of home talent, or in any hall paying the license tax described in Clauses 27, 28 and 29, they shall be exempt from the payment of license.

xxxi. For every single show under canvas the sum of $100.

xxxii. For every combined show under canvas the sum of $100.

3. And all shows, games or devices for public amusement or instruction for which a fee or charge is made or collected, on inclosed or open space, or under canvas, occupying not more than 200 square feet, shall pay $10 per day, and the same occupying not more than 700 square feet shall pay $25 per day, and the same occupying more than 700 square feet and not exceeding 7,000 square feet shall pay $35 per day, and the same occupying 7,000 square feet or more shall pay $75 per day: Provided, the same shall not be construed to apply to athletic sports.

7. It shall be the duty of every person beginning business in the city of ——, for which license tax is payable, to apply forthwith to the city treasurer and procure such license, which they shall exhibit to any officer of the city whenever thereto requested, and it is hereto made the duty of the mayor and aldermen and all constables and police

officers of the city to be vigilant in requiring this ordinance to be complied with and enforced.

16. To all delinquents of the license tax after the 1st day of June of each year, there shall be sent a printed notice by the city clerk, that if said tax is not paid to the city treasurer within 30 days a penalty of 5 per cent. will be added and the same can be returned to the mayor or to any alderman of the city for collection and on all of said delinquents to whom said notices are sent the city clerk shall receive 5 per cent. commission for his compensation.

17. That any person failing to take out a license or refusing to pay the license tax required by this ordinance or who shall violate any of the provisions thereof, shall, on conviction, be fined not less than $10 nor more than $50, and in default of payment thereof, together with costs, be imprisoned in the county jail not exceeding 30 days.

Another class of ordinances provides for regulation of various classes of places of amusement and for license fees intended mainly to pay the expenses of such regulation. These differ according to the local demands, and samples of such ordinances can be given if desired and the special class of amusement places to be regulated is named.

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### Charges Against An Engineer.

A civil engineer, who claims he is an expert in the water works business, makes a contract with a city to furnish plans and specifications to enlarge its water works. Advertisement for bids follows, contract is let, the city soon learns that he is "working" them by inferior material. Some of the well points are a dead loss for, on account of carelessness in making tests, they ran into mud instead of water-bearing gravel. He is discharged and the city puts its own engineer at work, under whom the plant is completed. On account of the inadequate supply of water due to the loss of two well points the city is put to the expense of $4,500. Before they learned the civil engineer was crooked and incompetent they paid $500, and he claims $360 balance due.

H., City Attorney, ——, Kan.

The above statement asks no question, but presumably what is wanted is an opinion as to the liability of the engineer. The statement is not complete enough to make this evident. The terms of the contract would govern and they are not given. It is not customary in this country for engineers to guarantee their work and the contract probably does not cover this, so that the engineer could not be held responsible for his errors. Whether he could recover the balance due on his fees or salary would depend almost entirely upon the terms of the contract with him. Whether he could be held criminally liable for his acts could be determined only by a suit, which would prove or disprove the allegations of fraud.

This question is an example of the indefinite charges which are too frequently made against public officials upon insufficient grounds and garbled reports of the opinions of persons unfavorable to the work under construction. City officials, especially the city attorney should take pains to get at the facts as nearly as possible before lending themselves to a movement which may be wholly unwarranted, or before making charges, the evidence supporting which might be suppressed or destroyed in case such public notice is given that the matter may be investigated.

The necessity of choosing an engineer with care and only after investigation of his record is also demonstrated. City councils are too apt to take a man on his own statement and personality because they are not all well informed in the engineering field and do not know just how to inform themselves as to the qualifications of an engineer. Any competent engineer can give references as to quality of work and integrity of character, and they should be investigated no matter what his reputation may be with some citizen, who is too often interested in one way or another in the success of the particular candidate in securing the job. The most dangerous advocate of an appointment is the man who has no particular interest aside from the desire to do a favor to a friend or a business connection in another city or a relative more less distant, for he assumes no responsibility, and shows that he can reap no personal advantage and so can talk loudly for a man concerning whom he really knows nothing.

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### Grades and Storage Batteries on Interurban Lines.

Kindly advise me what is the general practice as to ruling grades on interurban traction lines. Are the grades kept down to a few tenths of 1 per cent. (as on steam lines), or are 1 per cent. and 2 per cent. considered allowable? Are storage battery cars in successful use either in urban or interurban service? If so, where?

——, Okla.

Will our readers report their observations? On most of the earlier interurban electric lines little attention was paid to grades, and the surface of the roads was followed very closely, and 4 or 5 per cent. was not considered very excessive. Short grades of 10 or 12 per cent. were used in some cases. When the roads began to use their own rights of way the grades were reduced, but even then a line with a maximum grade of 2 per cent. was called a "nearly level" road.

The writer knows of no system of cars run by storage batteries which may be termed successful in all repects. They have been used only where special conditions required them.

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### Books on Land Drainage.

Have you any publication which treats of surface drainage for private places, telling the size of pipe to be used for mains and laterals in connection with catch basins and under drainage of grounds?

E. F. R., New York City.

Elliott's "Engineering for Land Drainage" ($1.50) and Elliott's "Practical Farm Drainage" ($1) will probably give the desired information.

# FROM WORKERS IN THE FIELD

### Price of Electricity for Pumping City Water Supply.

To the Editor of MUNICIPAL ENGINEERING:

Sir—In reply to C. D. P. inquiry in August number of the MUNICIPAL ENGINEERING, in reference to price paid to electric companies per kilowatt hour for pumping water in various municipal water works:

Electricity in the water works has now been used for more than fifteen years, and the electrically driven pump has taken a permanent place among the steam driven machinery.

Like all other machinery in water works or elsewhere, the electric pump has its limitations. There are situations, however, and they are very numerous in water works pumping, where the electric pump is not only a great convenience but a profitable investment. In any power or pumping device, the use of electricity is a question of service, cost of power and investment charge. Conditions in different localities differ, and no two installations are likely to be the same, viz: pressure (fire and domestic), hours of pumping (day or night), capacity of stand pipes or reservoirs, number of water consumers (flat rate or metered), total head, including suction, discharge, friction, etc.

Here are a few towns that purchase electricity for pumping water, also the price paid per kilowatt hour:

Lincoln, Ill., population 8,000, rate 5 cents to 2 cents per k.w.hr.

Dover, N. H., population 13,000, rate 2 cents per k.w.hr.

Norwood, Mass., population 9,000, rate 1.6 cents per k.w.hr.

Cheboygan, Mich., population 6,000, rate $26.50 per h.p. per year.

Other towns pumping water with electrically driven pumps are as follows:

Lima, Ohio; DeKalb, Ill.; Maywood, Ill.; Grand Haven, Mich.; Rockford, Ill.; East Douglass, Mass.; Dudley, Mass.; Harvey, Ill.; Lagrange, Ill.; Blue Island, Ill.; Holland, Mich.; North Chelmsford, Mass.; Uxbridge, Mass.; Webster, Mass.

A comparison as to cost of pumping water, electricity vs. steam, follows: This is for a town of 4,500 people in New England. 200,000 gallons of water pumped per day or 73,000,000 gallons per year. Water is pumped to reservoir from driven wells, pressure 62 pounds.

BY ELECTRIC POWER.

*Cost of Plant.*

| | |
|---|---|
| Brick pumping station, 20x20 ft.... | $ 800.00 |
| Grading, road, fences, etc..... | 150.00 |
| One 5½x8-inch double acting, triplex pump, capacity 220 gallons per minute, in place on foundations, with all measuring appurtenances, including sand and air chamber, and independent pump for renewing the latter, connected with one 20 h.p. electric motor..... | 1,835.00 |
| | $2,785.00 |

*Annual Expenses.*

| | |
|---|---|
| Interest on $2,785.00 at 4 per cent.. | $ 111.40 |
| Depreciation on pumping station, $800.00, at 2½ per cent..... | 20.00 |
| Depreciation on pumping plant, $1,835.00 at 5 per cent..... | 91.75 |
| Electric current purchased, 60,833 k.w.hrs. at 3 cents..... | 1,824.99 |
| Oil, waste, repairs..... | 50.00 |
| Attendance, one-eighth of one man's time ..... | 105.00 |
| | $2,203.14 |

BY STEAM POWER.

*Cost of Plant.*

| | |
|---|---|
| Brick pumping station, chimney, coal room..... | $6,300.00 |
| Grading, road, fences, etc..... | 250.00 |
| One 9x18x18½x12 duplex compound condensing pumping engine, capacity 220 gallons per minute, set in place, with all necessary appurtenances, connected with one 90 h.p. horizontal return tubular boiler complete in brick setting... | 4,750.00 |
| | $11,300.00 |

*Annual Expenses.*

| | |
|---|---|
| Interest on $11,300.00 at 4 per cent. | $ 452.00 |
| Depreciation on pumping station, $6,300.00, at 2½ per cent..... | 157.50 |
| Depreciation on pumping plant, $4,750.00, at 3 1-3 per cent..... | 158.33 |
| Boiler insurance ..... | 21.00 |
| 342 tons coal at $4.75 per net ton.. | 1,624.00 |
| Oil, waste, repairs, etc..... | 75.00 |
| Attendance, one-half of one man's time ..... | 420.00 |
| | $2,908.33 |

WILLIAM PLATTNER, Consulting Engineer, North Attleboro, Mass.

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### Back Filling Trenches.

To the Editor of MUNICIPAL ENGINEERING:

Sir—At the convention of the American Society of Municipal Improvements, held at Detroit in October, 1907, the writer read

a paper on "Back Filling Trenches," in which, among other things, he referred to the fact that when trenches are back filled by what is still the most common method by just puttng back what earth will get in the trench by handling with shovels, scrapers, tip carts or excavatng machines without any pretense of tamping the result is sure to, sooner or later, be serious settlement and damage to the pavement if not serious accident.

A recent example of this occurred in Boston. In July, 1902, we laid a bitulithic pavement on Hancock street, Boston (alongside the State House) incidentally having a 9 per cent. grade. The pavement has stood perfectly for ten years, but on May 25, 1912, a hole was discovered in the center of the street and examination developed a cavity about four feet deep and five feet wide. This is the final result (or perhaps is not yet the final result) of an old, loosely back-filled excavation made years before the laying of pavement ten years ago, during which early period the street was macadamized, and when the street was graded for laying the bitulithic years later no weakness developed. Fortunately, when the pavement finally "caved in" no other damage was done, but horses or people might easily have been passing at the time and a serious accident occurred.

It is of interest to note that, altho the bitulithic was laid on a bituminous foundation (crushed stone poured with bitumen), and, altho most of the foundation stone had fallen into the cavity, the pavement was still carrying traffic when the surface on a section about two feet in diameter of the "caved in" area broke thru.

With such facts as these before public officials (and almost every one has seen similar instances in his home city), it is really surprising what a lack of care is exercised by and enforced on contractors.

In this connection, about a year ago, in Wilmington, Del., the writer for the first time saw in operation a Staley tamping machine, which was doing such excellent and evidently economical work that it is surprising that so few cities have adopted this simple, effective and inexpensive machine.

WARREN BROTHERS COMPANY,
George C. Warren, Pres.,
Boston, Mass.

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**Cost of Making Cement Drain Tile.**

H. H. Mussselman, of Michigan Agricultural College, makes some estimates of the cost of making drain tile which are of much interest. In places where sand is difficult to obtain or where clay tile is extensively manufactured, the making of cement tile may not be advisable, but in sections where clay tile is not easily obtained and where sand is convenient, their cost will usually be found less than for the clay product.

In the following figures, which are furnished for estimating the cost of making cement tile, it must be kept in mind that they will be affected by local conditions in almost every case. The cost of labor, sand and gravel, kind of machine used, convenience of arrangement for manufacturing and number to be made will all affect this item. The factors which will affect the cost to the greatest degree are labor and the cost of sand laid down at the place of manufacture. The element of labor required is often neglected in making estimates of this kind, since it is assumed that at certain seasons of the year it cannot be used for other purposes.

The following figures are based on some rather short tests made by the farm mechanics department of the Michigan Agricultural College. Thes tile were made on a machine adaptable to both hand and power operating, the mixing being done by hand. Two men were required to operate the machine to the best advantage. On this machine from 400 to 500 tile could be made per day of ten hours by hand power and from 500 to 750 per day using small gasoline engine for power. Not more than one-half to one horse power was required to run the machine. In any case it would be of decided advantage to use power, and if a large number are to be made a mixer could be used which could be operated by power and thereby materially reduce the work connected with their manufacture. Making at the rate given above, the cement and sand have to be mixed in comparatively small batches, since no more should be mixed than can be used in a half hour.

All the figures given are for a 4-inch tile having a 9-16-inch wall. The cost of the size given should give a fair notion of the cost of the other common sizes. The proportions used were one to four of cement and sand, screened thru a ⅜-inch screen.

Cost of material and labor per thousand by hand power:

| | |
|---|---|
| 4.30 bbls. cement at $1.50 | $6.45 |
| 2.43 yards sand at $1.25 | 3.04 |
| 4.4 days' labor at $1.50 | 6.60 |
| Total | $16.09 |

Cost of material and labor per thousand by engine power:

| | |
|---|---|
| 4.20 bbls. cement at $1.50 | $6.30 |
| 2.34 yards sand at $1.25 | 2.93 |
| 3.3 days' labor at $1.50 | 5.00 |
| 1 gallon gasoline at 15 cents | .15 |
| Total | $14.38 |

The rate of making in the above figures is computed at 450 per day by hand power and at 600 per day using an engine for power. It will be seen that the cost of making by engine power will run from $1.50 to $2 less per thousand than by hand. It will also be noted that the items of cement and sand might each be much lower in some localities.

# CIVIC BEAUTY

## South Parks and Boulevards of Chicago.

BY LINN WHITE, ENGINEER SOUTH PARK DISTRICT.

By acts of the legislature of the state of Illinois, approved February 24 and April 16, 1869, the South Park district was created.

The acts referred to authorized the organization of a board of park commissioners consisting of five members, the term of one member expiring each year, the commissioners to be appointed by the circuit judges of Cook county.

The acts defined the limits of the park district and also the lands which were to be taken for park and boulevard purposes, and provided for the levying of a special assessment upon all property within the park district for the purchase of the lands, and also provided for the levying of taxes for the maintenance and improvement of the parks and boulevards.

The South Park commissioners have under their control about 60 miles of drives, including various boulevards and park drives, all drives varying from a maximum of 17,000 vehicles per twenty-four hours, of which 4,000 are heavily loaded traffic teams, which extreme condition occurs on the northern end of Michigan avenue, down to a minimum of a few hundred vehicles on the more remote boulevards situated so as to carry no other traffic. The comparatively few miles of boulevards in the downtown district carrying the heavy downtown traffic, such as the northern end of Michigan avenue and Jackson street, have long been paved in a substantial way.

Ninety per cent. of the sixty miles of drives in the system are paved with either plain or water-bound macadam. The straight away or thru traffic on the principal park drives and various boulevards thru the residence district at an average distance of six or seven miles from the center of the city amounts to from 3,000 to 5,000 vehicles per twenty-four hours in average fair weather, but may be greatly decreased during bad weather conditions or greatly increased on Sundays and holidays during fine weather. As traffic teams are excluded, at least 75 per cent. of the vehicles are automobiles, but on the numerous intersecting streets the general traffic moves unrestricted across boulevards, and must be added to the figures given above and must be reckoned with in considering effects of traffic on the pavement surfaces.

In 1908 the first surfacing was done by mixing method, amounting to about 10,000 square yards. At the beginning of the season of 1909 there was on the market a portable plant manufactured by the Link Belt Company, which embodied all the essential parts of an asphalt paving plant mounted on one truck. The South Park commissioners purchased two of these plants, which have been kept in use during the seasons of 1909-10-11-12, and, up to date, about 435,000 square yards of mixed bituminous wearing surface have been laid with them, principally over the old macadam. A comparatively small amount has been laid on new macadam base, but as no questions are involved differing from old macadam base, no special mention need be made of it. The method of doing the work has progressed from experiment to experience and from experience to what may be considered established practice in a somewhat similar process of evolution as that previously described for the pouring and penetration methods. More attention is now given to the preparation of the base with a coarse, open and grainy top, into which the surfacing mixture may be forced. In the earlier work done, the macadam surface was left comparatively smooth, and dependence was placed upon the composition of the mixtures and stability of binder to prevent shifting on surface.

One of the main attractions of the South Park system is the uniformity of the paving, which is kept up in first-class condition constantly. Winding and circulatory drives add to the beauty of a park system, but they must be kept as good as new or they will become an eyesore and a peril. All Chicagoans, and particularly all members of the South Park commission, point with pride to our drives.

Our method of paving is simple and effective. While we probably have more paving to do in the South Park than many cities of 600,000 population, we do not have a stationary paving plant. We have in operation a number of Twentieth Century portable asphalt paving machines, because the cost is less in proportion to the capacity than for

the permanent or stationary plant. By means of these portable machines, conditions are favorable to maximum economy of working, as all operations of the paving work are concentrated at one spot, on the street, under the eye of one man. Expensive losses and delays due to distant location of mixing plant are avoided. There are no long hauls of prepared material to entail delays and irregular deliveries. No broken harness or wagons, nor any traffic blockades can keep the paving men waiting in idleness. No loss of working time by wagons waiting in turn at the plant, or quitting before time because unable to complete another trip.

Raw materials can be hauled more economically than the prepared mixture, as regularity and speed of delivery are of less importance. Batches of prepared material can be more advantageously delivered on the street, and more evenly and economically spread in place, in small quantities wheeled in carts or barrows than in large loads brought in wagons.

The closeness of the plant to the work removes completely the cause and possibility of the familiar irregularities in asphalt paving, due to chilling of material and separation, however slight, of the stone from the asphalt, as occur unavoidably during long hauls.

Our machines are not at all complicated. To illustrate: One furnace and one fireman to do the heating of both aggregate and asphalt. One lever measures by automatic devices both aggregate and asphalt. The total number normally required to operate the plant, producing upwards to 800 square yards of 2-inch pavement per day, is as follows: Three men feeding dryer, one man tending asphalt tank, one fireman, one machine tender and oiler, one lever man measuring for mixer, one mixer man discharging finished material. When two machines are operated together, one asphalt tank man, one fireman and one machine tender serve them both.

The manner in which the forced draft is handled—suction on the firebox and blast thru the dryer—makes the most effective drying combination possible. The hot gases follow the dried material up the elevator shaft, utilizing the last practical unit of heat.

The asphalt melting tank is placed above the dryer, where it can receive heat directly from the furnace gases after they pass around the dryer, but means are provided, in suitable dampers and baffle plates, for regulating or cutting off the heat completely. The storage hopper and measuring box for the aggregate, the measuring valve for the asphalt and the mixer for the two are all housed in and protected, so there is no waste heat. The measuring devices for materials are exact, and when proportions are determined, each batch must come out exactly as wanted. The operator cannot vary the proportions by carelessness or intent.

The division of asphalt paving work into two distinct operations—the preparation of the material at a semi-portable plant located some distance away and the laying of the pavement on the street—has various disadvantages. These are entirely overcome by the use of such machines as we use, which makes one job of the entire work and places the whole proposition on a basis of maximum economy and satisfaction.

The larger amount of bituminous surfacing done has been made 2 inches thick; a lesser quantity, 1½ inches, and a considerably small quantity about 1 inch. The later conclusions are that a comparatively thin, completely waterproof wearing surface, with a strong, coarse layer of stone keying it to the macadam base and giving lateral stability, is the most logical, economical and successful construction, the layer of coarse stone corresponding somewhat to binder course in sheet asphalt pavements.

All of the surfacing done by the mixing method during the past four years, beginning with 1908, is giving good service, with less than one-half of 1 per cent. of repairs up to date. Some weaknesses of construction have developed at certain points where the stress of traffic has been the greatest and has occasioned the small amount of repairs referred to. On some of the earlier pieces of work, surface cracks or checks have appeared, but it is believed better methods of construction, particularly the use of a coarse, open stone base, has, to a large extent, overcome this tendency.

The two other park commissions in Chicago, the West Park commission and the Lincoln Park commission, have both adopted the same method for surfacing and are using the same machinery for mixing and preparing the material. Altogether, there have been laid, and are in service in Chicago, by the three park boards close to 1,000,000 square yards by the mixing method.

In conclusion, it may be said that the additional cost of surfacing by the mixing method over first-class construcion by the penetration method is so slight and the advantages obtained of uniform results and longer service are so considerable that every municipality should look carefully into it before deciding on the inferior method. It is probably true that it should not supersede the penetration method in all cases, but where there is growing traffic, urban, suburban or interurban, it will be a better proposition.

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### City Planning Congress at Duesseldorf, Germany.

Duesseldorf, the most beautiful and modern city in western Germany, known as the "Park City," and the center of the industrial empire with its extraordinary commercial and political developments, probably without a rival thruout Europe, is at present holding an exhibition on city planning, city operation and city administrative functions.

The exhibition will last from June 29th to October 31st, while the International Congress will be from the 23rd to the 28th of September.

The first group of exhibitions consists of general ground plans, traffic systems, such as railways, local and express facilities, elevated, subway, suspension and street railways, aviation stations, city embellishments, bridges, docks, parks, lawns, forests and real estate politics.

Under City Operation are grouped: Gas works, water works, electric central stations, sewerage systems, street cleaning, refuse disposal, cemeteries and crematories.

Under the third group, Administrative Functions, are exhibited plans and models of hospitals, rescue homes, poor houses, lodging houses, orphan asylums, homes for widows and the aged and infirm, schools, churches, museums, art galleries, libraries, concert halls, etc.

It will be noticed from the foregoing items that this exhibition is planned with the well-known German thoroness so that hardly any subject is omitted that is of importance in city planning, city operation and administration.

The addresses and papers will be read in the principal languages, German, English, French, etc.

Duesseldorf is one of the most progressive of all European cities. The eminent writer, Frederick C. Howe, after a careful study of the city, says: "I have often dreamed of a city whose ideals rose above mere business, a city that was built like a home, that had a communal bigness of vision, that was planned by city builders, and that serves its people as a father might serve his children, and I have seen such cities in Germany, the nation which has alone recognized the portentous significance of the change which has taken place in the distribution of population. Of all German cities, I think Duesseldorf is easily the first. It is not an old residence city like Dresden or Munich. It is a comparatively new city like Cleveland, Milwaukee, Indianapolis, or Kansas City. Its population was about 69,000 people in 1871. In 1910 it was 300,000. Duesseldorf, too, is an industrial city of mills, factories and workshops. It is one of the best governed cities in the world. It has dreamed dreams and dared to carry them into execution. It is almost as beautiful as Washington, as full of joy of living as Paris and is managed with more scrupulous honesty, more scientific efficiency and more devoted pride than almost any American business corporation. The city is built for the comfort and convenience of its people. It is designed as master architects might design a world's fair to which all mankind was invited for education, recreation and art. But the thing that most distinguishes Duesseldorf is this—her people and her officials seem to appreciate that congestion of population has made it necessary for the city to own many things and do many things. Duesseldorf was not a natural harbor. The waterfront, which extends for miles along the Rhine, was low-lying land. The bank opposite the city was covered with shacks and huts, which were torn down and the land developed into a beautiful parkway several miles in extent. The city side was reclaimed from the river and confined with stone embankments. A wide esplanade was constructed upon which several public buildings as well as a splendid exhibition building have been erected. In the latter annual exhibits of art are held. Further up the river a system of docks was constructed with powerful cranes and devices which handle all kinds of freight at an insignificant cost. Crossing the river is a beautiful bridge upon which hundreds of thousands of dollars were spent merely to make it beautiful. The remarkable thing about this undertaking is the way business is made to harmonize with art and beauty. The use of the river front for recreation is not impaired by the docks and railroad tracks. Duesseldorf is laid out like a great park. Everywhere are parks and playgrounds as artistic and varied as the landscape architect can make them. The entire river bank is a promenade and driveway. The parks run into the heart of the business district. Thru the center of the town is a broad mall with the moat of the old city in the center."

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### A Practical Glass Street Sign.

BY. L. A. DUMOND, ENGINEER OF COMMITTEE ON DOWNTOWN STREETS, CHICAGO ASSOCIATION OF COMMERCE.

The Committee on Downtown Streets of the Chicago Association of Commerce was organized something over a year ago for the purpose of promoting improved conditions in Chicago's downtown district.

The need of a uniform and adequate system of street signs in the downtown district was one of the first matters to attract their attention. A study has since been made of the different street signs used in the large cities of America and Europe. One of the first conclusions reached by the committee was that the most beautiful streets, other things being equal, were those that were the least obstructed, and that it would be one of their objects to do away as far as possible with existing obstructions and prevent any further obstructions.

The first problem which presented itself was the selection of a street sign which could be mounted upon all buildings regardless of age, color or style of architecture, which would not be affected by the elements, which would require no maintenance expense, and which would be legible both day and night.

It was evident after some study that no enamel sign could meet all the above conditions. The cost of metal signs was prohibitive and they require almost daily attention to prevent them becoming illegible.

About this time reports were received from the chairman of the committee in London

concerning the success of a glass sign recently introduced there and in several other cities of England.

The sign consists of a heavy opalized glass plate, one-half inch in thickness, mounted in a heavy zinc framework and is given added stability by a backing of portland cement grout from one-eighth to one-fourth of an inch in thickness. The letters are large and of simple design. They are put on the plate by means of a sand blast, the black enamel is applied and the plate is baked at a high temperature until the enamel becomes permanently vitrified into the glass.

The manufacturer in London made sample signs marked "Dearborn Street" and one of these signs was mounted for a time on the Marquette Building, at the corner of Dearborn and Adams streets. This sign could easily be read at a distance of three hundred feet in the daytime, while a blue enameled sign at the same corner upon a post could scarcely be distinguished at half the distance.

It was decided as an experiment to make up enough of these signs to equip Dearborn and LaSalle streets from Madison to Jackson boulevard, and to obtain the consent of the property owners to put them on their buildings. It was found that the signs could be made in Chicago for about the same money as the signs, duty and transportation charges if they were made in London.

Specifications were drawn and bids asked from Chicago manufacturers.

The job was given to the Rawson & Evans Company, of Chicago, to whom we are indebted for the accompanying photograph of a sign, and has just been satisfactorily completed. The attempt will be made to interview all of the property owners concerned and get the signs mounted within the next few weeks.

The glass street sign, which we believe is being introduced for the first time in America, is not claimed to be the ideal sign, but does seem to possess the following advantages to a greater degree than signs of other materials:

(1) It is cheap.

(2) There is practically no maintenance expense.

(3) It is not affected by the elements.

(4) It does not detract from the appearance of the building upon which it is mounted.

(5) Rain falling upon the sign washes the surface.

(6) The surface does not readily collect dust.

(7) It is legible for a great distance.

The specifications for the signs read as follows, omitting the general clauses in the contract:

*Glass Plate*—The plate shall consist of a white glazed slag material (trade name opalized glass) one-half inch in thickness, six inches in width, and of a length such that when the plate is mounted in the frame there shall always be a blank space at either end of the name of one and one-fourth inches.

*Metal Frame*—The metal frame shall be made of zinc in weight and form similar to the sample submitted, except that the lugs for mounting shall be fastened to the framework by copper set screws three-sixteenths inch in diameter, and holes for fastening the lugs provided on the top and bottom of the frame. All holes for mounting lugs to the frame shall be bored one inch from the corners of the same.

Note—It was originally intended to make the lugs interchangeable as indicated above but it was found to be impractical to make satisfactory threads in a zinc framework one-eighth of an inch in thickness. The lugs were "sweated" to the framework upon the top and bottom of the same at the ends.

*Mounting of Glass Plate*—The glass plate shall be mounted as follows: A surplus of soft putty shall be placed in the curved recess at the inner edge of the framework and the glass plate forced into the frame until it rests evenly upon the framework. Enough putty shall be provided so that when the glass plate is placed in the framework the surplus shall be forced up between the edge

of the glass plate and the framework for a distance of at least one-eighth inch. The glass plate shall be held in the framework by four copper clips in a manner similar to the sample submitted. The concrete backing shall be a one to one mixture of portland cement and sand mixed wet. The sand to be used shall be clean, sharp, and coarse. The concrete shall be firmly pressed into the framework and the surface smoothed with a trowel. The concrete shall be allowed to set at least seven days before the sign is moved. If the concrete backing is applied in a heated room then the sign must be kept covered and sprinkled with water at least once a day after the first day.

*Lettering*—The lettering shall be in form similar to the sample submitted. The first letter of each name or abbreviation shall be four and one-half inches in height. The remaining letters shall be three and three-fourths inches in height. The letters shall be eroded one thirty-second inch deep by some sand blast process. They shall be colored in black enamel and permanently vitrified into the glass.

The contract called for 78 signs distributed on Dearborn, LaSalle, Madison, Monroe, Adams, Jackson, Sherman and Quincy streets and they cost $3.25 each ready to be set.

# MOTOR VEHICLES

**Direction Signal for Fire Apparatus.**

Ever since the introduction of the silent alarm system in Baltimore the problem that has confronted the police of the traffic squad has been to determine, on sighting the fire engines, whether the engines would go straight on a street or turn out at any particular intersection. In the congested section of the city the keeping of a clear way for the fire apparatus was thus rendered more difficult until one of the engineers of the Baltimore fire department invented the signal apparatus which is shown in the accompanying picture.

This signal, which is being tried out on one of the high pressure automobile hose wagons, consists of a large red and white striped paddle and is operated by the man who sits beside the driver of the machine and who also sounds the alarm bell. If the machine is going straight across any intersecting streets then the paddle remains upright, but if it is proposed to turn either to left or right, the paddle is lowered to the side to which the turn will be made.

DIRECTION SIGNAL ON BALTIMORE FIRE APPARATUS.

As it is possible for a policeman to see the paddle at a distance of a city block he has ample time to clear the way in the necessary direction. Although the signal system has been in use but a few weeks, it has proven so satisfactory that all of the apparatus of the department will be equipped with it.

As this is the only signal apparatus of its kind in the country it is probable that other cities will investigate its worth with a view to adopting something of a similar nature.

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**Municipal Automobiles of Louisville, Ky.**

The motor machine is in high favor with the heads of all the departments of the Louisville city government, as well as with the subordinates. The fact that old Dobbin was not long ago entirely eliminated in the city service in favor of motor power in the street cleaning, police, fire and other departments, is because of of the lack of appropriations sufficient to bring this about. As it is, Louisville has made a good start along this line, and the executives hope to see additional automobiles purchased each year, until practically every city department is served by them.

The first substitution of the motor machine for horse power was in the police department, where a motor patrol was put into use. At that time but one was purchased, but it was quickly followed by others, in addition to a touring car for the use of the chief of police and his aides on official business. The next purchase was a machine for the chief of the fire department. It has been in use for two years, the first one in the police department having been in use three years. The board of works was next to authorize the purchase of motor machines, supplying one for the superintendent of streets, one for the use of the board members and one for the city engineer.

The motor equipment of the various departments of the city of Louisville consists of the following:

Police department, three Oldsmobile auto patrols, one Cadillac auto patrol, three Cadillac passenger or touring cars for the use of the officers of the department, and one Autocar touring car for the use of the detective force. The board of public safety, Col. E. T. Tierney, chairman, which has charge of the police and fire departments, the city hospital, almshouse and workhouse, has adopted a plan in connection with the purchase of motor cars for the various departments which has proven very successful. This plan is to purchase a chassis of a given make and have the rest of the machine built in Louisville to plans drawn by the engineer of the department. In this way the board has not only economized, but it has secured cars, or patrols, exactly suited to the purposes desired.

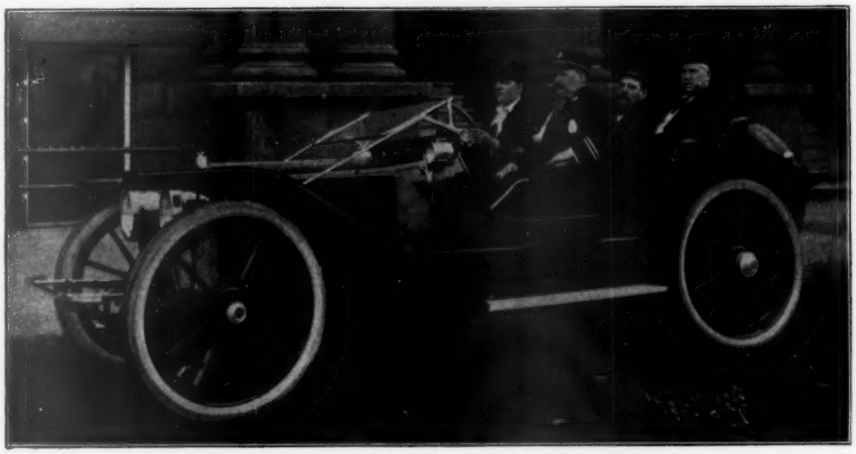
Most of the officials in charge of departments using autos indorse motor power for the city departments with which they are connected.

Col. H. Watson Lindsey, chief of police, says: "I consider the motor machines in use in my department one of the very best assets. The advantages of motor-driven cars over horse power are so numerous that I would have to go to great lengths to enumerate them. Suffice it to say that a modern police department without motor cars is sadly handicapped. I only wish we had more."

Major Timothy Lehan, chief of the fire department, states: "I am strong for the motor-driven fire apparatus. It helps in many instances to save thousands of dollars worth of property by enabling the firemen to reach the scene of a conflagration in the shortest space of time. I have found the use of the machine provided for me of great assistance. In addition to my car, which is an American Traveler, and which has been in use for three years, the master mechanic of the department has one. Not only do motor-driven machines aid in reaching the scene of a fire in record time, but they are cheaper to maintain than horse-drawn apparatus."

The board of public works uses a sixty-horsepower Stearns; the city engineer uses a thirty-horsepower Chalmers; the superintendent of streets, William McFarland, a forty-horsepower Hudson, and Superintendent of Sewer Construction Andrew Kast uses a car which has been turned over to him by the sewer commission, that body having gone out of existence.

The board of public safety is now having built a sixty-horsepower ambulance for the use of the city hospital, an Oldsmobile chassis having been purchased and the rest of the car built in Louisville, as in the case of the auto patrols.



MUNICIPAL AUTOMOBILES OF LOUISVILLE, KY.
Chief's Car With Chief Timothy Lehan and Assistant Chiefs.

None of the city officers are more enthusiastic over motor-driven apparatus for city work than Mayor W. O. Head. Mayor Head, in discussing the innovation, said:

It is impossible for the heads of the various departments of a municipal government to keep their forces up to a high state of efficiency without the use, to an extent at least, of modern equipment, such as the motor-driven machines. This naturally applies especially to the police and fire departments, altho in the street work, the hospital work and other ways they are just as important. I find that motor-driven cars or apparatus not only increase the efficiency of the different departments, but they are more economical than the horse-drawn, power-propelled apparatus.

The handling of problems which confront the executives of a city administration calls for modern equipment, and, as I suggested before, the motor machine stands at the front

in this connection. I am in sympathy with the substitution of motor equipment for horse-drawn equipment as rapidly as it can be done without the sacrifice of any property which we now have.

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**Automobiles for the City Engineer.**

The first automobile purchased for the use of the city engineer's department in Detroit was put in service in 1907. It is a "Northern" five passenger car with body designed for the carriage of the field instruments of an engineering party and is shown in the accompanying photograph. Mr. R. H. McCormick, the city engineer, states that this was the first automobile purchased and used in a city engineer's department in this country. It is still in use by his sewer department and is now in its fifth year of service.

THE FIRST CITY ENGINEER'S CAR.

Three other automobiles have since been purchased on definite specifications prepared by Mr. McCormick. They are Warren cars and cost $1,325 each, complete, including top, wind shield and all essential appurtenances.

A comparison of cost of horse service and automobile service is hardly fair to the automobile, for the present outfit of automobiles enables the department to take care of the present work, which is nearly double that required in the days of horse vehicles, with no increase in the number of men. Some indication of the saving in using automobiles is given, however, by the statement of facts:

When horse vehicles were in use the department owned five wagons and two buggies. No horses were owned and they were hired, without drivers, at a rate of $3.50 a day for each team. An inspection of his record showed average livery bills of about $62 a month. The four automobiles, three five passenger cars and one run-about, are kept in the garage of the department of public works and rent and attendance are not charged to the cars. Gasoline, oil, other supplies and repairs average very near $25 a month.

The horse vehicles and automobile accounts are very closely upon the same basis, each including expense for motive power, supplies and repairs, altho neither includes all the expense connected with them. Depreciation also is not included. A complete comparison would require consideration of this item, but, judging from the present condition of the cars in use and their first cost, the probably higher charge against the automobiles for depreciation will not offset the saving in operating expenses, not to mention the saving in salaries of men on account of the larger amount of work the force can take care of in a day.

The cost of operating automobiles is also comparable with that of the ordinary citizen who takes care of his own machine and pays no garage rent. The department cost is extremely low, on this basis, and some may question the completeness of the account. It is stated as shown by Mr. McCormick's records and he would doubtless be willing to go into greater detail of items included if our readers are interested.

# ORGANIZATIONS & INDIVIDUALS

### American Road Congress.

Of special interest to engineers, highway officials and manufacturers of road material and machinery, is the construction and maintenance section of the American Road Congress to be held at Atlantic City, September 30 to October 5. Col. E. A. Stevens, State Commissioner of Roads of New Jersey, is the chairman of the Construction and Maintenance Section of the Congress. This section will deal with streets, roads, park drives, bridges, and culverts. The subjects discussed will be sub-divided in a manner unusual to road conventions. Instead of subdividing the subject under the headings of diffferent types of roads, the division will be made on the different problems of road construction.

In one sub-section for instances, there will be discussed location and grades. Question 1, will deal with surveys, discussion lasting twenty minutes; Question 22, with new location, while under another subdivision there will be a discussion of rights of way; Question 3, of sub-section A, will deal with grades, tractive resistance of various surfaces, relation to traffic, etc.

Civil service will be thoroughly considered in its application to road management. Gen. John C. Black, chairman of the United States Civil Service Commission, will make one of the addresses on this subject. He will explain the importance of putting the civil service, or merit test, to every man having anything to do with the supervision of the roads.

Every other phase of the roads subject will be handled in the same scientific manner. The most eminent bankers will discuss methods for safe-guarding a proper accounting of taxes and assuring business methods in obtaining loans or making bond issues to build good roads. There is to be a legislative section which will endeavor to point the way to needed reforms in road legislation. The president of the American Bar Association is lending his assistance in preparing the program for this particular section of the Congress.

In conjunction with the Congress, there will be a conference of educators with a view to having highway engineering introduced in colleges on a scale that will meet modern requirements. Engineers experienced in road building are not plentiful and if the colleges could be induced to introduce the right kind of courses one of the greatest needs of the road movement would be supplied.

Logan Waller Page, director of the Office of Public Roads, and active president of the congress, believes that the gathering in Atlantic City will put the road movement on such a basis that the time will not be long distant when twenty per cent of the public highways will have been improved. Mr. Page estimates that the improvement of twenty per cent of the roads will bring this nation's road system to a high point of efficiency, almost equal to that of France.

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### American Road Builders' Association.

The invitation extended by the Mayor and the Commercial Association of the City of Cincinnati to the American Road Builders' Association to hold its ninth annual convention in that city has been accepted. The convention and the American Good Roads Congress which is held in connection with the convention, will, therefore, be held in Music Hall, Cincinnati, December 3, 4, 5 and 6.

In connection with the annual convention of the association, there will be held, as usual, an exhibition of machinery, materials and methods of road construction in Music Hall in space which has been set aside for the purpose. The building has a floor space of over 50,000 square feet and it is expected that all this space will be required for the exhibits. Not only will the manufacturers of material and machinery be represented in this exhibition, but the several states will have booths set aside for them in which they will exhibit, models of roads, photographs, drawings and road materials.

The president of the Association is Nelson P. Lewis, chief engineer Board of Estimate and Apportionment of New York City; first vice-president, Harold Parker, ex-chairman of the Massachusetts State Highway Commission; treasurer, Maj. W. W. Crosby, consulting engineer of the Maryland State Highway Commission; secretary, E. L. Powers, New York City.

### Technical Associations.

At the annual meeting of the Colorado Association of the American Society of Civil Engineers the following officers were elected: President, Prof. M. S. Ketchum; vice president, A. O. Ridgway; secretary and treasurer, G. N. Houston.

At the sixth annual convention of the Illuminating Engineering Society to be held at the Hotel Clifton, Niagara Falls, Ont., September 16-19, the following papers will be given, "High Pressure Gas Lighting," F. W. Goodenough; "Indirect and Semi-Indirect Illumination," T. W. Rolph; "Recent Developments in Series Street Lighting," Dr. C. P. Steinmetz; "Reflection from Colored Surfaces," C. W. Jordan; "Determination of Illumination Efficiency," E. L. Elliott.

The organizing committee of the sixth congress of the International Association for Testing Materials has just issued an advance bulletin of the congress to be held in New York, September 2-7, 1912. In addition to the eight technical sessions, six of which will be in three simultaneous meetings, there will be numerous receptions and excursions in and around New York, and an official tour, September 8-15, from New York, thru Washington, Pittsburgh, Buffalo, Niagara Falls and back to New York.

The August meeting of the American Society of Engineer Draftsmen was held in the Engineering Societies' Building, New York City, on Thursday, the 15th inst. A paper by W. T. Walters, a Chicago member, on Safety Devices, their Application and Design, was read, followed by Prof. Chas. Wm. Weick, of Columbia University, who gave a lecture on Practical Perspective.

### Calendar of Technical Meetings.

International Congress for Testing Materials—Sixth congress at New York City, September 2-7. Secretary of organizing committee, H. F. J. Porter, 29 West Thirty-ninth street, New York.

International Congress of Applied Chemistry—September 4, at Washington; September 6-13, at New York City. Bernard C. Hesse, secretary, 25 Broad street, New York.

International Association of Fire Engineers—Annual convention, Denver Col., September 17-20. James McFall, secretary, Roanoke, Va.

New England Water Works Association—Thirty-first annual convention, Washington, D. C., September 18-19. Willard Kent, secretary, Headquarters, Boston, Mass.

American Public Health Association.—Washington, D. C., September 18-20. Seldcar N. Gunn, secretary, 289 Fourth avenue, New York, N. Y.

Fifteenth Congress on Hygiene and Demography.—Meeting, Washington, D. C., September 23-28.—Dr. John S. Fulton, Secretary, Army Medical Museum, Washington, D. C.

Central States Water Works Association—Sixteenth annual convention, Detroit, Mich., September 24-26. R. P. Bricker, secretary, Shelby, O.

American Road Congress—Annual Meeting, Atlantic City, N. J., September 30 to October 5. Logan Waller Page, president, Washington, D. C.

New York Fire Exposition and International Conference of Fire Prevention, Protection and Extinguishment — Seventy-first Regiment Armory, New York City, October 2-12. A. D. V. Storey, secretary, 1269 Broadway, New York, N. Y.

American Society of Municipal Improvements—Annual convention, Dallas, Tex., November 12-15. A. Prescott Folwell, secretary, 50 Union Square, New York City.

American Road Builders' Association.—Ninth Annual Convention, Music Hall, Cincinnati, O., December 3-6. E. L. Powers, secretary, 150 Nassau street, New York City.

National Association of Cement Users.—Annual Convention, Pittsburgh, Pa., December 12-18. R. L. Humphrey, president, Harrison Building, Philadelphia, Pa.

### Personal Notes.

T. H. Mandell has been elected city engineer of Lake Charles, La.

Harry P. Willis, Assoc. M. Am. Soc. C. E., chief engineer of the New York State Department of Highways, has resigned.

Melvin C. Hazen has been reappointed surveyor of the District of Columbia, which position he has held since 1908.

Henry W. E. Rabe has been appointed superintendent of the water works and sewerage departments of Galveston, Texas.

B. H. Klyce, Assoc. M. Am. Soc. C. E., formerly city engineer of Jackson, Miss., has been made city engineer of Waycross, Ga., succeeding H. H. Pafford, resigned.

Prof. William J. Carrell, associate professor of civil engineering at the State University of Kentucky, has been appointed bridge engineer in the Highway Department of that State.

Joseph W. Shirley, Baltimore, Md., chief engineer of the Topographical Survey Commission, has been appointed a member of the Baltimore City Planning Commission, succeeding W. H. Fehsenfeld.

Irving W. Barbour, Portland, Ore., has resigned his position as field engineer of the water department, to become a highway engineer with the United States Office of Public Roads, Washington, D. C.

F. F. Longley, Assoc. M. Am. Soc. C. E., resident engineer of the Toronto, Ont., water filtration plant, has resigned, to become a member of the firm of Hazen & Whipple, consulting engineers, New York City.

James E. Barlow, Assoc. M. Am. Soc. C. E., engineer with the Bureau of Municipal Research, Cincinnati, Ohio, has been appointed principal assistant city engineer of Cincinnati, succeeding G. D. Baker, resigned.

Ewing & Stone Co., civil and consulting engineers, 1742-43 Monadnock Block, Chicago, Ill., announce the change of their firm name to Central Engineering Bureau, at the same address. This firm specializes in municipal and public works.

Prof. James F. Kemp, of the department of geology, Columbia University, has gone to the Panama Canal Zone to make a special study of the geological conditions in the Culebra cut for the Isthmian Canal Commission.

E. W. Robinson has been appointed city engineer of Webb City, Mo., after having served as assistant engineer for three years. The former engineer, A. J. McKenzie, Assoc. Mem. Am. Soc. C. E., has resigned to enter construction work.

Adolph O. Krieger has resigned as publicity manager of the Busch-Sulzer Bros.-Diesel Engine Co., St. Louis, to open an office at 916 Victoria Building, St. Louis, for the sale of the Tacchella oil burning device. Waller Edwards has been appointed publicity manager of the Busch-Sulzer Bros.-Diesel Engine Co.

# MACHINERY AND TRADE

### The "Roturbo" Centrifugal Pump.

The modern and successful development of rotary machinery in the form of electric motors and steam turbines has reacted on the centrifugal pump and created a demand for a design to meet all pumping problems and the highest efficiency, avoiding gearing and reducing cost, weight and expense. Until about ten years ago it was generally agreed that centrifugal pumps were only suitable for low lifts and large volume of water—such as occur in irrigation, sewage and salvage work and for circulating water for condensers.

The efforts of the early designers that the centrifugal type should not be limited to a few of the pumping problems of the world is shown by the patents taken out in the attempt to overcome the well-known difficulties, and to make the centrifugal pump suitable for high lifts by using a number of impellers in series.

The delayed development was largely due to the fact that to get the best results from a centrifugal pump, impellers should be of small diameters running at high speed, rather than of large diameters running at low speed, but until the advent of the electric motor and steam turbine there was no means of driving centrifugal pumps at the necessary speed except thru belting or gearing with their inseparable difficulties and losses in transmission, which neutralized the advantages aimed at in the pumps.

Perhaps the defect which has been the most difficult to overcome and which has decided the buyer in many cases against this type of pump, has been the fact that it would only work at its best at the exact head for which it was designed. The reason of this being that the blades of the impeller were shaped so as to pass a certain amount of water with the minimum friction of loss, due to cavitation; but if the head against which the centrifugal pump is working is reduced, a greatly increased volume of water passes and the impeller then becomes unsuitable for the increased speed of the water thru it and begins to act as a water brake, thus creating an overload on the driving machine. Large numbers of motor driven centrifugal pumps have given trouble or been burnt out by reason of this inherent defect (if they have not had a large margin of power). Since the variation of head either in the suction or delivery is one of the commonest conditions met with in pumping problems, it has been a large handicap to the wider introduction of centrifugal pumps.

The problem of varying heads has been met by the invention known as the Rees pressure-chamber impeller, which was placed on the market in Europe in 1907 by the Rees Roturbo Manufacturing Company, of Wolverhampton, England. The invention has been protected by patents in every country in the world by the parent company, the Rees Roturbo Development Syndicate, Ltd., Wolverhampton, England. The sole right to manufacture and sell Roturbo pumps in this country and Canada has recently been obtained from the Rees Roturbo Development Syndicate, Ltd., by the Manistee Iron Works, of Manistee, Michigan.

The characteristic feature of this pump is that it is a true turbine pump, the "rotor" has a strong "turbine" effect, due to the water passing. The turbine effect is secured by making the rotor of large capacity for storing water which is maintained by rotation at a constant maximum internal pressure with the minimum amount of loss, consequently, instead of throwing away the surplus speed energy of the water discharged when the head of delivery is reduced, the energy is extracted from the water before it leaves the pump casing.

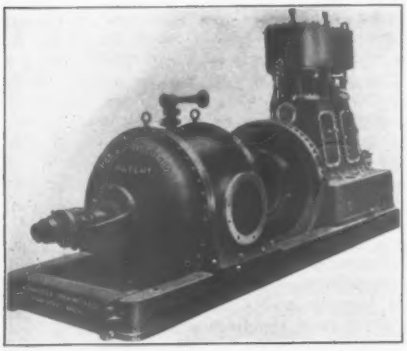
In the Roturbo pump the design differs from the ordinary impeller or flat disc runner, which is formed with the main object of securing velocity of the water in the expanding channels of the fixed casing.

With the Roturbo pressure-chamber, the water, after being picked up at the eye, becomes practically stationary, relatively to the pressure-chamber itself, thus eliminating friction and losses, and generating a pressure by centrifugal force.

The inner portion of the impeller between the eye and the largest section of the pressure-chamber may be looked upon as a centrifugal pump proper and the blades of this portion are designed similarly to those of an ordinary centrifugal pump. The rim portion, beyond pressure-chamber, is designed as a reaction turbine, having rearwardly di-

rected nozzles, discharging from the pressure-chamber.

The pump is therefore always discharging with a constant pressure, which is the ideal condition for a centrifugal pump, and the turbine is always discharging from a constant pressure which is the ideal condition for a turbine. The result of a combination of a pump and turbine, with a pressure-chamber between them, is that the self-regulation is perfect, and at any heads lower than normal duty the power taken from the motor is prevented from rising. As the speed of the water passing through the pressure-chamber is reduced, internal friction is reduced to a minimum and a high efficiency



THE ROTURDO CENTRIFUGAL PUMP.

is secured without the necessity of machining or polishing blades or surfaces. The internal wear is also minimized.

The Roturbo pumps, are operating for pumping sewage, mines, coal mines, boiler feeds, pressure augmentors for city service, fire protection, dock pumping, cooling towers and condensing plants, etc.

Due to the self-regulating characteristics of this pump, the streams can be delivered through any number of hosepipes without overloading the engine when the head is reduced. Consequently the maximum power of the engine can be utilized at all times no matter what the head may be, since it runs at constant speed.

### The Clay Products Exposition.

The second annual show of the Clay Products Exposition Company in Chicago this coming winter, will extend over a period of twelve days instead if six days. Secretary Hopley and his assistants are beginning to put into effect the preliminary plans for the event.

In addition to many new features, which will not only interest the visitors, but assist in creating a demand for clay products, the lines represented will be extended and, where other branches of the industry were merely represented last season, full displays will be presented. This is true, particularly of the pottery interests.

A feature that is to be added to this year's show will be the prizes offered the exhibitors. One prize is to be given for the

CLAY PRODUCTS EXPOSITION
For 1913 Feb 26 to Mar 8
FEBRUARY
MARCH
Everything in Clay from Art to Utility
Open to Public 12 Days. Coliseum, Chicago

most novel display; another for the most beautiful display; another for the largest single display, and still another for the most practical display. Allotment of space to exhibitors will be made September 20.

### Progress of the Wire-Cut-Lug Brick.

During the month of July three more large brick manufacturing companies have contracted for the production of the Dunn wire-cut-lug brick. They were the Foster Paving Block Co., Bradford, Pa.; the Bessemer Limestone Co., Youngstown, O., with two plants, and the Metropolitan Paving Brick Co., Canton, O., with six plants.

The advance of the wire-cut-lug brick has been remarkable. Starting with only two plants equipped in 1910, in less than two years, fifteen manufacturers, with twenty-four plants, have been licensed to make brick under the Dunn patents. In that time four hundred and fifty cities have admitted this type of brick under the specifications.

### A Squeegee Street Washing Machine.

The Kindling street washing machine is a German invention, which has for some years been in successful operation. It has become more popular, until now it is in general use in the municipalities of the continent, and is universally recognized as one of the most thoro and economical of all machines for the cleaning of smooth pavements —asphalt, bitulithic, tar macadam, wooden block and brick. It is manufactured by the Kindling Machinery Co., Milwaukee, Wis.

The operation of the Kindling street washing machine is very simple. The tank feeds four sprinklers, between the front and rear wheels, all operated with valves by the driver on the seat. One or more of these sprinklers can be used at the same time, according to the amount of water required to remove the accumulation on the pavement, or the water supply can be shut off entirely, when the pavement is already wet enough, as after a heavy rain.

Geared to the left hind wheel is the cleaning roller, or squeegee. This is a heavy steel cylinder, with twenty-four rubber fins, each seven feet long, five and one-fourth inches wide, and five-sixteenths of an inch thick. As the cylinder revolves, the rubber removes the mud, dust and slime from the pavement.

To the right of the driver's seat is a lever, by which the cleaning roller can be raised or lowered. Should the roller be too high, the counterweight may be set back a few inches; if too low, set it forward. On the counterweight are two iron plates which can be removed as required. The rubber blades should merely touch the pavement and should not be bent very much; the latter position not only causes the rubber to break and wear faster, but has a tendency to smear the accumulation instead of removing it.

Many of these machines have been placed in operation by the city of New York. Foster Crowell, former commissioner of street cleaning, New York City, states: "Experiments have shown that in the residential districts the squeegee uses only an average of 0.11 to 0.12 gallon of water to each square yard of surface cleaned, while in the more congested districts, the rate runs from 0.125 to 0.250 gallon to the yard, as a greater quantity of water must be used there to loosen the accumulated dirt.

By a recent series of interesting experiments the sanitary efficiency of the squeegee has been pretty well demonstrated, as well as its economy. Bacteria culture plates were exposed in the streets in different localities, and the number of bacteria colonies which developed on them during exposures at the same localities as before and after street cleaning by means of the squeegees was some measure of the sanitary effectiveness of the machines.

In Fifth avenue, for instance, between Seventh and Eighth streets, a plate exposure before the street was cleansed developed 200 colonies but after the street had been cleansed a new exposure showed their number had been reduced to only 29."

SQUEEGEE STREET WASHERS.
The Street Washing Machines in Operation.

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**The Matthews Interlocking Signs.**

There is one very important point in road and street improvement that has been neglected, namely, the proper and effective marking of the streets with permanent and serviceable signs. Few cities and villages have given this subject the attention it so much deserves and few realize the importance and necessity of an effective and uniform system of street markings or the very great convenience which is thereby given to the public.

Cities which have placed signs on their streets in the old way of nailing them up on convenient buildings, poles, fences or trees, are beginning to realize that this method is inadequate and ineffective because of the rapid growth of the cities and villages, the changes in mode of travel, the greatly increased number of strangers being daily brought into the city by the improved facilities offered by electric power, and also that they are undesirable from an artistic point of view. The old style and manner of installing street signs is not found satisfactory because it is necessary to place the signs parallel to the street which allows of their being read from but one direction; they are not permanent because, generally placed on private property, they are soon destroyed by one means or another, they are not uniform as to location and therefore not readily found during the day and never at night.

The driver of an automobile does not know where to look for the sign put up in this

manner and in order to find it must take his attention from his machine and this at a time when he is about to cross an intersecting street, a time when his whole and undivided attention should be given to the handling of the automobile. If he finds the sign at all, the chances are that he has by that time gone so far across the intersecting street that it is impossible to make the turn and it is necessary to stop, reverse and back up to a point from which the turn can be made.

The street sign manufactured by the Mathews Interlocking Sign Company, White Plains, N. Y., is a device by means of which a uniform system of street markings is possible; the sign at each intersection is the same. It can be seen and read from all four directions. It is durable, being composed entirely of metals not subject to the action of the elements. The sign plates are bright and do not require painting.

The Mathews signs have been adopted by the state highway departments of New Jersey and New York and by over forty cities, villages and towns during the first year of their manufacture.

### Motor Grass Mower.

The larger the city, the more serious the problem is for keeping the grass in good order. The ordinary horse lawn mower in its most efficient condition in a day's operatiin can only take care of one and a half or two acres, according to the nature of the ground, and when our parks run into anything from one hundred to eight hundred acres, the simple operation of mowing the grass becomes a great problem.

Grass growing experts state that after the winter frosts the upper turf has been raised up and there is an air space between it and the lower soil thru the action of the frost. The only way to insure a strong, healthy growth of grass is to get these two layers in touch with each other early in the season, otherwise the roots of the grass become impoverished as the spring advances, because they have not thoroly reached the nourishing soil below. This is where the motor lawn mower can do more good in the early spring than fertilizers can do later in the season. A strong, healthy growth of grass gets a start which the summer heat can not burn, with ordinary care. A close, velvety surface of grass is the surest way of keeping out weeds.

The latest model of motor lawn mower built by the Austin Manufacturing Company, Chicago, is designed to take care of large tracts of grass in the most efficient manner. This machine has a 16-horse power engine on it with self-oiling system, magneto ignition and mechanically operated valves. Their double speed transmission gear is made of vanadium steel, case hardened, running on steel roller bearings enclosed in a dust-proof, oil-tight gear box. No chains or sprocket wheels with their loose sliding bearings are permissible in a machine built for durability and easy maintenance. Every gear is enclosed and runs in oil.

MOTOR LAWN MOWER.
Machine in Use in South Park District, Chicago.

### Motor-Driven Concrete Mixer.

The accompanying illustration shows a gasoline concrete mixing outfit with discharging trough or chute for street work. The chute will distribute the concrete over a considerable area avoiding shoveling and wheeling. This mixer is built low and is so designed that it can be charged direct from barrows, requiring only slightly inclined runways, instead of being high above the ground necessitating the use of some form of mechanical charging device, or the putting up

and taking down of expensive high charging platforms.

The discharge is a patented invention and is so designed that it discharges high enough above the ground to afford ample clearance. The batch may be discharged in wheelbarrow loads or as a unit.

The discharging arrangement is semi-automatic and the discharge door is opened from either end of the drum, dispensing with the services of a man to operate the discharging device. The charging platform is attached to the truck and this, together with the inclined runways, is portable as a unit with the machine.

The drum of "The Standard" concrete mixer is made with flanged steel heads, riveted to surrounding shell of rolled plate steel

THE STANDARD CONCRETE MIXER.

which is reinforced with two heavy rings or bands with flare for rollers and one or both of the bands are provided with gear for driving.

The drum is supported by trunnion rollers which tread against the flare of the track bands. It is rotated by pinions meshing into gear bands, the power being transmitted thru the shaft on which these pinions are placed.

At the charging end there are a large circular opening in the flanged head and diagonal overlapping charging blades which carry the material into the drum. These charging blades extend within the plane of opening and are attached to the flanged head and also to the interior of the shell. The charging end of the drum is open, allowing the entire batch of concrete to be seen while being mixed.

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**Hendricks' Commercial Register.**

The twenty-first annual revised edition of Hendricks' Commercial Register of the United States for buyers and sellers has just been issued. Established in 1891, it has been published annually since that time and is the most complete work of its kind in existence. Its aim is to furnish complete classified lists of manufacturers for the benefit of those who want to buy as well as for those who have something to sell. It covers very completely the architectural, engineering, electrical, mechanical, railroad, mining, manufacturing and kindred trades and professions.

The present is by far the most complete edition of this work so far published. The twentieth edition required 108 pages to index its contents, while the twenty-first edition requires 122 pages, or 14 additional pages. As there are upwards of four hundred classifications on each page, the fourteen additional pages represent the manufacturers of over 5,000 articles, none of which have appeared in any previous edition. The twentieth edition numbered 1,419 pages, while the twenty-first edition numbers 1,574 or 155 additional pages.

**Trade Notes.**

Philadelphia, Pa.—The Civil Service Corporation has been formed to take over and prosecute the public utility and general engineering businesses which have formerly been conducted individually by T. Wilson Battin and by A. L. Osgood. These gentlemen have been in the business for a number of years in an advisory capacity for others and are turning over and consolidating several going concerns. The officers of the new corporation are G. Henry Stetson, president; T. Wilson Battin, vice president; J. Lee Patton, treasurer, and A. L. Osgood, secretary.

Chicago, Ill.—The Jeffrey Mfg. Co. have moved their Chicago headquarters and offices from the Fisher Building to the McCormick Building, recently completed. S. S. Shive, sales engineer, is the district manager. The Jeffrey Mfg. Co. maintain fourteen branch offices in the United States and over one hundred agents in the leading commercial centers all over the world.

Patchogue, L. I.—Dayton Hodges has purchased a second portable drying and mixing outfit for road work from the Ruggles-Coles Engineering Co., 50 Church street, New York.

The Foreign Commercial Bureau Co., 50 Church street, New York City, has received the privilege from the United States government of placing in every American consulate a completely briefed and indexed resume of the catalogs of American manufacturers in every branch of industry. Such catalogs are arranged in card form, are printed in Spanish, German, Portugese, French and English, or such other language as may be necessary, are arranged under the names of the manufacturer and also under the title of his product, and are shipped in complete and compact form. MUNICIPAL ENGINEERING will be found on file in the London and Paris offices of this company.

**Patents Concerning Reinforced Concrete.**

889,820. Reinforced Wall. Antoine Z. Chiodo, Cairo, Egypt.

890,032, 890,033, 890,034, 890,035, 890,056. Unit Bars, Frames and Reinforcement for Concrete Construction. Julian O. Ellinger. New York, N. Y.

890,428. Reinforced Concrete Construction. John W. Lingee, Jr., Boston, Mass.

890,545. Reinforcement. John J. Whitacre, Canton, O.

891,234. Reinforcing Bar for Cementitious Bodies. Edward F. Crane, Newark, N. J.

891,929. Reinforced Concrete Structure. Geo. M. Graham, Chicago, Ill.

893,272. Concrete Structure (reinforced). Chas. E. Springer, Chicago, Ill.

893,640. Reinforced Girder. Ernest A. Moccetti, Paris, France.

893,792. Reinforcement for Concrete or Cement Construction. Wm. C. Gabriel, Auburn, Ind.

894,997. Reinforced Concrete Construction Member. Robert Anderson, Cincinnati, Ohio.

896,589. Bar for Concrete Construction. Julius H. Schlafly, Canton, O.

896,679. Reinforced Concrete Beam. Hiram B. Andrews, Melrose, Mass.

900,379. Reinforcing Bar. Alfred C. R. Janni, St. Louis, Mo.

901,551. Reinforced Structure. Daniel W. Norton, Vincennes, Ind.

902,027. Reinforced Cement Culvert. Clifford D. Voris, Crawfordsville, Ind.

902,335. Reinforce for Concrete Structures. John M. Sherwood, Bridgeport, Conn.

903,903. Reinforcing Device for Concrete Structures. John T. Simpson, Newark, N. J.

903,909. Reinforced Concrete Construction. Chas. R. Steiner, Gridley Colony No. 8, Cal.

904,283. Reinforcing Device for Concrete Structures. John T. Simpson, Newark, N. J.

904,785. Reinforcing Bar for Concrete Construction. John V. Jenkins, Wichita, Kan.

904,977, 904,978. Tension Bars and Devices for Concrete Constructions. Geo. S. Miles, New York, N. Y.

905,056. Armored Concrete Construction. Edmond Coignet, Paris, France.

905,480 Reinforcing Bar for Concrete Structures. Avila Thomas, Detroit, Mich.

906,479. Concrete Reinforcement. John J. Whitacre, Canton, O.

908,783. Reinforced Concrete Construction for Piers and Docks. Englebrit C. Lawrence and Oscar F. Lackey, Baltimore, Md.

908,805. Reinforced Concrete Manhole Cover. John P. Rogers, Topeka, Kan.

909,850. Metal Reinforce for Concrete. Gordon F. Dodge, Chicago, Ill.

910,124. Girder for Reinforcing Concrete Structures. Geo. M. Graham, Chicago, Ill.

910,469, 910,470. Reinforcing Frame for Concrete Structures. Geo. M. Graham, Chicago, Ill.

910,837. Girder (reinforced concrete). Ernest A. Moccetti, Paris, France.

910,947. Reinforced Concrete Supporting Beam. Jas. Needs, Takenham, Eng.

911,062. Deformed Bar. Frank V. McMullins, Edgewood, Pa.

913,083. Reinforced Concrete Construction. Elbert F. Wilcox, Kansas City, Mo.

913,603. Reinforcing Bar for Concrete Work. Edward C. Woodward, Raleigh, N. C.

915,590. Reinforced Concrete Retaining Wall. Edward Godfrey, Pittsburg, Pa.

917,304. Metal Reinforce. Albert L. Johnson, St. Louis, Mo.

917,822. Metal Reinforce for Concrete Structures. Eli White, New York, N. Y.

917,787. Bar for Reinforcing Concrete. Alfred L. Lindau, St. Louis, Mo.

918,019. Strengthening Member for Composite Cement and Metal Constructions. Oliver M. Davis, Detroit, Mich.

918,231. Reinforced Concrete Construction. Wm. J. Warren, Yuba City, Cal.

918,366. Reinforced Concrete. Hamell J. Quireau, Baldwinsville, N. Y.

918,715, 918,716. Metallic Reinforcements for Concrete Construction. Daniel A. Wedmore, Philadelphia,, Pa.

919,100. Metallic Reinforce for Concrete Construction. Daniel A. Wedmore, Philadelphia, Pa.

919,273. Reinforcing Truss for Concrete Structures. Herbert E. White, Youngstown, O.

919,714. Reinforced Concrete Structure. Geo. M. Graham, Chicago, Ill.

921,626. Reinforced Concrete Construction. Walther Raster, Chicago, Ill.

922,305. Means for Reinforcing Concrete. Edmond G. du Mazuel, New York, N. Y.

924,090. Reinforced Concrete Construction. Egbert J Moore, Yonkers, N. Y.

925,643. Shear-Bar for Reinforced Concrete Construction. Chas. T. Lindsay, Pittsburg, Pa.

925,750. Concrete Reinforcing Bar. Elie Cannes, New York, N. Y.

925,989. Reinforcing Means for Concrete Structures.—Eldridge R. Boyle and Wm. H. Upton, Washington, D. C.

926,005, 926,006. Reinforcing Devices Wm. T. Kerlin, Rockfield and Edward W. Bowen, Delphi, Ind.

927,194. Reinforced Concrete Beam. C. A. P. Turner, Minneapolis, Minn.

928,192. Reinforced Concrete Cattle Guard. John H. Hammill, Cedar Rapids, Iowa.

928,430. Reinforcing Bar for Concrete Construction. Jas. M. Dudley,, Bessemer, Ala.

928,475. Means for Reinforcing Concrete Constructions. John T. Simpson, Newark, N. J.

929,728. Reinforced Revetment. John H. Taylor, Waterloo, Neb.

931,049. Reinforced Concrete Construction. Ralph de Lacaire Foster and Gustav Schulz, San Diego, Cal.

931,185. Reinforcing Bar for Concrete. Jas. M. Dudley, Bessemer, Ala.

931,320. Reinforcing Bar for Concrete Construction. Preston T. Large, North Tonawanda, N. Y.

931,322. Reinforcing Bar. Alfred E. Lindau, St. Louis, Mo.

933,261. Reinforced Construction of Walls (Tunnel.) John T. Flynn, San Francisco, Cal.

934,089. Reinforced Concrete Structure. Ernest McCullough, Chicago, Ill.

934,378. Concrete Reinforce. Herbert E. White, Youngstown, O.

937,178. Method of Manufacturing Reinforced Tubular or Hollow Bodies. Louis H. Reutzsch, Meissen, Germany.

938,660, 938,661. Reinforcing Framer for Concrete Structures and Method of Erecting. Geo. M. Graham, Chicago, Ill.

938,662. Reinforced Concrete Structure. Geo. M. Graham, Chicago, Ill.

939,403. Reinforcing Bar for Concrete. Jas. M. Dudley, Bessemer, Ala.

939,962. Reinforcing Bar. Thos. W. Jenks, Avalon, Pa.

940,399. Concrete Steel Construction (reinforcing bar.) Wm. Mueser, New York, N. Y.

941,078. Reinforced Concrete Pile for Pier and Foundation Construction. Cassius E. Lamburth, San Francisco, Cal.

942,142. Reinforced Concrete Piling. Jas. P. Holmes, Ocean City, N. J.

942,202. Metallic Reinforcing Bar for Concrete Construction. Richard J. Grace, Portland, Ore.

942,625. Reinforced Concrete Structure. Maurice Dumas, Brussels, Belgium.

943,310. Reinforcing Construction for Concrete. John W. Linzee, Jr., Boston, Mass.

943,402. Metal Reinforcement for Metal Reinforced Concrete Construction. Wm. S. Ferguson, Cleveland, O.

943,878. Reinforcement Bar. Wm. G. Hughes, Pittsburg, Pa.

944,110. Reinforced Concrete Construction. Samuel H. Summerscales, Winnipeg, Man., Can.

944,589. Reinforcing Bar for Concrete Structures. Daniel Baum, Jr., Omaha, Neb.

946,890. Reinforced Concrete Construction. Chas. D. Watson, Ben Avon, Pa., and Albert W. Buel, New York, N. Y.

947,044. Reinforcing Structure. Geo. J. Schade, Sandusky, O.

947,199. Reinforcing Bar for Concrete Structures. Albert C. Kuester, Philadelphia, Pa.

947,746. Concrete Reinforcement. Herbert E. White, Youngstown, O.

947,750. Reinforced Concrete Structure. Eugene N. Hunting, Youngstown, O.

949,262. Reinforced Concrete Construction. Percy W. Cook, Lidcup, Eng.

950,401. Reinforced Concrete Construction. Chas. W. Peckham, Haven, Kan.

952,891. Reinforcement for Concrete Construction. Julian O. Ellinger, New York, N. Y.

953,368. Reinforced Concrete Construction. Sydney Burrowes, Niagara Falls Center, Ontario, Can.

954,128. Reinforced Concrete. Robert McLaughlin, Baltimore, Md.

954,750. Reinforced Concrete Bridge. John E. Mandeville, Hawley, Pa.

954,900. Trussed Bar for Reinforced Concrete Construction. Pietro Stragiotto, Hurley, Wis.

954,925. Reinforcement for Concrete Structures. Chas. Brossmann, Indianapolis, Ind.

955,236. Reinforced Concrete Construction. Edmund P. Wells, Clapham, London, Eng.

956,194. Reinforced Concrete. Wm. F. Scott, Toronto, Ontario, Can.

957,244. Reinforced Concrete. Pierrepont B. Noyer. Oneida, N. Y.

960,382. Reinforcement for Concrete Structures. Ralph E. Newton, Milwaukee, Wis.

960,666. Reinforced Concrete Tower. Louis F. H. Mifforus, Aylmer, Que.

961,619. Reinforced Concrete Construction. Jas. Hanner Knight, Westtown, Pa.

962,488. Concrete Reinforcement. Robert S. Allyn, New York, N. Y.

963,218. Reinforced Concrete Structure. John Gilmore, Montrose, S. D.

965,070. Unit Reforcing Frame for Concrete Construction. Eugene L. Brown, Jr., St. Louis, Mo.

965,729. Reinforcing Structure for Concrete. Elliott E. Nickson, Philadelphia, Pa.

966,291. Reinforced Concrete. Glenn Allen, San Francisco, Cal.

967,390. Reinforcing Bar. Albert L. Johnson, St. Louis, Mo.

967,427. Reinforced Concrete Pipe. John M. Phelan, Jackson, Mich.

967,505. Reinforcing Element for Concrete Structures. John A. Ettler, San Francisco, Cal.

968,125. Machine for Making Reinforced Concrete Piles, Columns and the Like. Alex Crawford Chenoweth, New York, N. Y.

968,982. Concrete Reinforcement. Geo. V. Rhines, Toledo, O.

969,039. Reinforced Concrete Structure. Wm. Pierce Cowles, Minneapolis, Minn.

969,408. Composite Wall Construction. Roy Henry Robinson, Chicago, Ill.

981,353. Reinforcement for Concrete Structures. Geo. A. Brayton, Martin's Ferry and Edwin C. Roberts, Bridgeport, O.

972,961. Metallic Reinforce for Concrete Construction. Daniel A. Wedmore, Philadelphia, Pa.

974,656, 974,657, 974,658, 974,659. Reinforced Concrete Structures. Geo. M. Graham, Chicago, Ill.

975,307. Reinforced Concrete Structure. Herbert E. White, Youngstown, O., and Wm. H. Ham, New York.

975,381. Retaining Wall. Frank A. Bone, Cincinnati, O.

978,361. Reinforced Arch, Bridge or Viaduct. Robert A. Cummins, Beaver, Pa.

979,285. Reinforced Concrete Construction. John Gilligan, Nebraska City, Neb.

979,564. Reinforced Concrete Construction. Frank S. Robinson, Detroit, Mich.

979,776. Reinforced Structure. Daniel B. Luten, Indianapolis, Ind.

980,414. Reinforcing Device for Concrete. Chas. A. Hanson, Chicago, Ill.

981,516. Reinforcing Means for Concrete Structures. Robert Anderson, Cincinnati, O.

982,080, 982,081. Concrete Water Tanks. John H. McCoy, Harnsville, Pa.

982,682. Corrugated Bar. Albert L. Johnson, St. Louis, Mo.

982,697, 982,698. Bulkhead and Retaining Wall. Maxwell M. Upson, Englewood, N. J.

983,274. Reinforced Concrete. Geo. M. Graham, Chicago, Ill.

984,494. Reinforcing Structure. Joseph F. Russell, Battle Creek, Mich.

984,747. Machine for Making Reinforced Concrete Piles, Columns and the Like. Alex. C. Chenoweth, New York, N. Y.

984,775. Reinforcement for Concrete. Christopher J. Morgan, Glassport, Pa.

985,640. Reinforced Concrete Structure. Wm. J. Stewart, Belfast, Ireland.

985,734. Concrete Reinforcement. Raymond W. Dull, Aurora, Ill.

986,143. Cistern or Tank (Reinforced Concrete). Arthur B. Crawford, Hastings, Neb.

986,474. Reinforced Concrete Construction. Henry L. Lewen, New York, N. Y.

988,951. Reinforced Concrete Structure. Wm. C. Sauer, Pearlbrach, Mich.

989,120. Reinforcement for Structures of Concrete. Herbert F. Cobb., Cleveland, O.

989,830. Reinforced Concrete Construction. Frederick A. Berne, Birmingham, Ala.

990,963. Reinforced Concrete Structure. Denis Wm. Daley, Parkersburg, W. Va.

991,439. Reinforcing Rod or Bar for Cement, Concrete or Similar Material. Newton L. Hall, Denver, Col.

991,971. Reinforced Concrete Construction. Secondo Giletti, San Francisco, Cal.

992,970. Concrete Reinforcement. Edward McClure, Chicago, Ill.

994,091. Reinforcement for Concrete Constructions. Hugues Brussel, St. Louis, Mo.

994,325. Truss Bar for Concrete Construction. David Maxwell, Detroit, Mich.

995,009. Reinforced Concrete Wall and Like Structure. Geo. W. Jackson, Chicago, Ill.

995,069. Reinforced Concrete Construction. Henry L. Lewen, San Francisco, Cal.

996,288. Reinforced Concrete. Thos. H. Skinner, Oneida, N. Y.

996,843. Sea Wall or Wharf Construction. (Reinforced Concrete). Chas. F. Francisco, San Diego, Cal.

997,493. Reinforcing Concrete. Geo. S. Gallegher, New York, N. Y.

999,663. Reinforced Concrete Construction. Daniel B. Luten, Indianapolis, Ind.

1,001,682. Reinforced Concrete Conduit. Mason D. Pratt, Harrisburg, Pa.

1,002,565. Reinforcing Bar for Concrete and Similar Structures. Wm. C. Congell, Youngstown, O.

1,007,187. Form for Molding Reinforced Concrete Conduits. Geo. W. Cross, Ft. Smith, Ark.

# IMPROVEMENT AND CONTRACTING NEWS

## ROADS AND PAVEMENTS.

### BIDS REQUESTED

Anderson, Ind.—Sept. 7, 10 a. m. Constructing the Jas. G. Clark, Geo. E. Adams, aand No. 4 free gravel roads. Joel B. Benefiiel, auditor of Madison county.

Beech Grove, Ind.—Sept. 3, 9 p. m. Paving Fifth avenue with crushed stone and constructing sidewalks and curbing. Merrill Johnson, town clerk.

Bloomington, Ind.—Sept. 3. Constructing the Nathan Cooter gravel road in Monroe county. Horace Blakely, auditor.

Bloomington, Ind.—Sept 3. Constructing a gravel road known as the J. T. Acuff road. Horace Blakely, auditor.

Brazil, Ind.—Sept. 6, 11:30 a. m. Constructing the Alex Medesitt and Wm. Francis gravel roads. E. A. Staggs, auditor of Clay county.

Corydon, Ind.—Sept. 3. Constructing seven gravel roads in Harrison county. Wm. Taylor, auditor.

Crown Point, Ind.—Sept. 4, 12 m. Constructing the L. J. Rhodes road, the Geo. Hess road, and the E. H. Gehrke road in Lake county. Chas. A. Johnson, auditor.

Decatur, Ind.—Sept. 4, 10 a. m. Constructing a macadamized road in Adams county, known as Julius Haugh road. H. S. Michaud, auditor.

Franklin, Ind.—Sept. 3, 10 a. m. Constructing gravel roads known as E. E. Trisler and J. T. Applegate gravel roads. H. L. Knox, auditor of Johnson county.

Indianapolis, Ind.—Sept. 6, 10 a. m. Constructing a stone road on the line between Hendricks and Marion counties. H. T. Patten, auditor of Marion county.

Indianapolis, Ind.—Sept. 6, 10 a. m. Constructing cement sidewalks on both sides of Maple road. Dr. Henry Jameson, president Board of Park Commissioners.

Lawrenceburg, Ind.—Sept. 3, 2 p. m. Constructing three gravel roads known as the Grubbs, Haley, and Geo. W. Sawdon roads. Wm. S. Fagaley, auditor of Dearborn county.

Marion, Ind.—Sept. 3, 2 p. m. Constructing gravel roads in Washington and Center townships. E. H. Kimball, auditor of Grant county.

Marion, Ind.—Sept. 5, 10:30 a. m. Constructing a gravel road on the line between Grant, Wabash and Miami counties. E. H. Kimball, auditor of Grant county.

Monticello, Ind.—Sept. 3, 10 a. m. Constructing a gravel road known as Wm. H. Parks road, in White county. A. G. Fisher, auditor.

Monticello, Ind.—Sept. 3, 10 a. m. Constructing the C. E. Gay gravel road in White county. A. G. Fisher, auditor.

Mt. Vernon, Ind.—Sept. 7, 2 p. m. Constructing two gravel roads in Posey county. Joseph R. Haines, auditor.

Plymouth, Ind.—Sept. 5, 1 p. m. Constructing the J. H. Matchett stone road in Marshall county. Geo. F. McCoy, auditor.

Rensselaer, Ind.—Sept. 3, 4 p. m. Constructing the George Naninger and Chas. E. Kersey gravel roads. J. P. Hammond, auditor.

Shelbyville, Ind.—Sept. 4, 10 a. m. Constructing a gravel road in Shelby county. Frank W. Fogel, auditor.

Sullivan, Ind.—Sept, 3, 12 m. Constructing a gravel road, known as E. M. Purcell road. W. S. Bicknell, auditor.

Washington, Ind.—Sept. 3, 2 p. m. Constructing the E. E. Ritterskamp and the James F. Thompson roads. Lew S. Gore, auditor of Daviess county.

Williamsport, Ind.—Sept. 6, 1 p. m. Constructing the Jacob Troxell gravel road in Warren county. David H. Moffitt, auditor.

Cincinnati, O.—Sept. 13, 12 m. Improving Clough Creek pike under specifications No. 385. Certified check, $2,000. Stanley Struble, president; Albert Reinhardt, clerk, board of Hamilton county commissioners.

East Youngstown, O.—Sept. 9, 12 m. Paving Wilson avenue with brick. Certified check 2 per cent. P. J. Carney, clerk.

Lisbon, O.—Sept. 9, 1 p. m. Grading and paving a mile of road with brick at Wellsville, O. Certified check, $500. H. C. McCamon, president; P. R. Walker, chief clerk, board of commissioners of Columbia county.

Huntington, W. Va.—Sept. 9, 1:30 p. m. Paving a number of alleys. Certified check, $500. L. A. Pollock, commissioner of streets; A. B. Maupin, city engineer.

### CONTRACTS AWARDED.

Greenville, Ala.—Constructing the Forest Home road, to Andrew E. Perry.

Little Rock, Ark.—Paving East Third street with creosoted wood blocks, to E. J. Weterstrom.

San Diego, Cal.—Constructing sidewalks and street improvement at Normal Heights, to George H. Oswald, $292,983.

Wilmington, Del.—Constructing the Ashland-Yorklyn road to B. L. Wickersham, $24,639.

Belvidere, Ill. — Constructing macadam paving on West Locust and Buchanan streets, to Fair & Taylor.

Galesburg, Ill.—Paving North street, to J. B. McAuley, $20,384.75.

Moline, Ill.—Paving Seventh street, to the Western Improvement Co., Racine, Wis., $37,625; paving Thirteenth street, to I. D. Lain, $4,800.

Monmouth, Ill.—Paving West Boston, avenue, district including 18 blocks, to the Burlington Construction Co., Burlington, Ill.

Paris, Ill.—Paving two miles of brick roads, to Alan J. Parish, $27,400.

Paxton, Ill.—Paving Market, Spruce and State streets, to Edward Patton, Veedersburg, Ind.

Peoria, Ill.—Paving Spring street with brick, to John McAllister, and resurfacing Bigelow street with asphalt, to J. H. Bushel & Co.

Peoria, Ill.—Paving Spring street with brick, to Douglass A. Myers, $5,664.20.

Peoria, Ill.—Paving Chambers street with brick and constructing a 12-inch pipe sewer in the same street, also curbs, to the Canterbury Bros., $19,554.80.

Quincy, Ill.—Constructing creosoted wood block pavement on streets near Washington Park, to Henry Rees, $24,417.

Rock Island, Ill.—Paving Twenty-seventh street, to the Independent Construction Co., Davenport, Iowa, $1.95 per square yard for brick paving and 65 cents for concrete gutters.

Waukegan, Ill.—Paving Steel Court and Cory avenues, to the Boyne Construction Co.

Brazil, Ind.—Paving National avenue with Tarvia X, to Hawkins Bros., $28,848.20.

Connersville, Ind.—Constructing a macadam road, to Amos U. Stevens.

Logansport, Ind.—The following road contracts have been awarded: Constructing the Browning road, to Shaffer & Browning, $6,965; the McDonald road, to Martin McHale, $15,982; Clingenpeel road, to Walter Girton, $5,843.

Seymour, Ind.—The following paving contracts have been awarded: Constructing the Jackson-Redding Township road with stone, to Chris Moritz, $3,894; constructing roads in Carr township, to Hague & Massena, $7,384.

South Bend, Ind.—Paving several streets in the Merrifield additions, to Rankert & Eggleston, $1.40 per square yard for asphaltic concrete.

Centerville, Iowa—Paving Fifth and West Van Buren street, to B. S. Staley, at $1.41 per yard for paving and 30 cents per foot for curbing.

Charles City, Ia.—Paving Wisconsin street, including 12,000 yds, to the Bryant Asphalt Paving Co., Waterloo, Ia., $1.70 per sq. yd.

Council Bluffs, Ia.—The following paving contracts have been awarded: Paving Pine street, to the Independent Construction Co.; paving an alley, to the Hydraulic Construction Co.

Glenwood, Ia.—Repaving Vine street, to Dunagan & Hamlinton, Shenandoah, Ia., about $11,000.

Oelwein, Ia.—Constructing 40,000 ft. of sarcolithic paving, to Wm. Horribin & Co., Iowa City, Ia.

Perry, Ia.—Paving Otley avenue, to W. G. Birdsall.

Vinton, Ia.—Paving nine blocks of city street, to F. H. Hann, Cedar Rapids, Ia.

Atchison, Kas.—Paving three blocks of alleys, to the Land Construction Co., $2,164.59.

Baltimore, Md.—Paving several streets, to the United States Asphalt Co.

Springfield, Mass.—Paving Elm street, to Laniel O'Connel's Sons, Holyoke, Mass., $12,300.

Grand Rapids, Mich.—Paving several streets, to Carpenter & Anderson, $33,000.

Iron Mountain, Mich.—Grading the Granite Bluff and Foster City roads, to J. E. Blomgren, Norway, Mich.

Monroe, Mich.—Paving Elm street, to the Fidelity Construction Co., Ann Arbor, Mich., $18,331; paving Second street, to the Toledo Asphalt Block Co., $35,811.

Duluth, Minn.—Paving Parkside avenue, to P. McDonnell, $28,000; constructing concrete curb and gutters, to August Bodin, $1,500.

Meridian, Miss.—Constructing sidewalks on several streets, to P. C. Powers & Sons, $26,668.50.

Carrollton, Mo.—The following paving contracts have been awarded the Columbia Paving Co.: Lincoln avenue, $16,703.40; West Washington avenue, $2,788.30; West Fourth street, $615.

Fulton, Mo.—Grading a road, to Mulville Bros., $28,700. The contract includes about 28 miles of highway.

St. Joseph, Mo.—Paving Sylvanie street with mineral rubber, to the Metropolitan Paving Co.

Rochester, N. Y.—Improving the East Side Boulevard, to Whitmore, Rauber & Vicinus, $50,781.

Troy, N. Y.—Paving Eighth street, to Warren Bros., Boston Mass., about $20,000.

Belmont, O.—Paving the Belmont National road, to Petris & Turner, $17,600.

Bryan, O.—Paving South Main, East and West Wilson and East Hights street with Metropolitan paving blocks, to E. A. Freshwater & Sons, $55,000.

Bucyrus, O.—Constructing five miles of pike road, to Christ Reiff and Dave Shumaker, $22,000.

Cincinnati, O.—Paving Moore street to the Kirchner Construction Co.

Columbus, O.—The following street improvement contracts have been awarded: Cleveland avenue with brick, to George Garnes & Co., $15,321; Terrace avenue with asphalt, to Andrews Paving Co., $5,673; Indianola avenue with asphalt, to Andrews Paving Co., $8,492; Eighteenth avenue with asphalt, to Andrew Paving Co.; Parkwood avenue with asphalt to A. G. Pugh & Co., $8,000.

Findlay, O.—Constructing brick paving on South Main street, to C. B. Hall & Son, $8,538.

Fostoria, O.—Paving Maple and Poplar streets, to the Modern Construction Co., Fremont, O.

Fostoria, O.—The following road contracts have been awarded: The Buckley road, to J. J. Peters, $2,400; the Sandusky road, to the Bluffton Stone Co., $4,400.

Hamilton, O.—Paving Walnut street with sheet asphalt, to the Andrews Asphalt Paving Co.

Lancaster, O.—Paving Pearl avenue with Nelsonville block, to Charles Justus, $5,177.04.

Lima, O.—Paving Walnut and Baker alleys, to H. S. Enck.

Lisbon, O.—Constructing one mile of the Lisbon-Hanoverton road, to Patterson & Grafton, East Liverpool, O., $15,458.

Lisbon, O.—Paving the Minerva-Lisbon road, to George Patterson and N. F. Grafton, $15,458.74.

Marion, O.—Paving South Seffner and Blaine avenues, to the Cleveland Trinidad Paving Co., Cleveland, O.

Perrysburg, O.—Paving Main street with Wassall brick, to T. J. Mulligan, Lima, O.

Portsmouth, O.—Paving one mile of the Chillicothe pike, to Henry P. Kaps, $12,537.

Steubenville, O.—The following paving contracts have been awarded: West Adams street, to H. M. Bates; Alley D, to the same; Alley B, to the same; Ohio street, to J. O. Bates.

Uhrichsville, O.—Paving the Trenton avenue bridge with creosoted wood blocks, to Capital Construction Co.

Youngstown, O.—The following grading have been awarded; Grading and sewering Ohio avenue, to the Youngstown Construction Co., $1,347.70; grading Valley street, to John McVean, $2,113; grading Augusta street, to William Hynes, $299.40; paving Wellendorf avenue, to Turner & Olson, $11,822.75; paving Albert street, to Patrick Mylott, $16,248.10; paving Oxford avenue, to R. C. Shook, $2,295.05; paving Murdock street, to Joseph Hannon, $3,442; paving Martin street, E. J. Kane, $7,456.30; grading Manhattan avenue, to R. C. Shook, $1,101.60.

Youngstown, O.—Paving Struthers road, to Martin & Fleming.

Youngstown, O.—The following grading contracts have been awarded: Oneta street, to R. C. Shook, $2,324; Jones street, to Joseph Morrison, $3,212.74.

Zanesville, O.—The following paving contracts have been awarded: To Adams Bros, Woodlawn avenue, $1.53 per sq. yd;

Spurk street, $1.22 per sq. yd; Harrison street, $1.53, and Elborn avenue, $1.55.

Durant, Okla.—Paving Third avenue, to the Cleveland-Trinidad Co., of Oklahoma City, Okla.

Nowata, Okla.—Constructing paving in district No. 4, to the Davis Construction Co.

Altoona, Pa.—Resurfacing Seventh avenue and other streets, to the Union Paving Co., Schenectady, N. Y., 96 cents per sq. yd.

Beaver Falls, Pa.—Grading and paving Beaver street, to A. V. Purnell, Pittsburgh, Pa.

Camden, Pa.—Paving Second street, including 23,000 sq. yds., to Aaron Ward, $2.55 per sq. yd.

Franklin, Pa.—Paving Liberty and Thirteenth streets, to the Northwestern Construction Co.

Franklin, Pa.—Constructing a highway in Mercer county, to the Northwestern Construction Co., $35,817.09.

Monongahela, Pa. — Improving Fourth street, to Reed, Liggett & Britt, Washington, Pa. $20,219.50.

Philadelphia, Pa.—Paving South Bethlehem street, including 18,000 sq. yds., to Richard P. Bennis, $31,990.50.

Roscoe, Pa.—Paving 8,000 ft. of Railroad street, to Frank Manella, Pittsburgh, Pa., $16,000.

Sayre, Pa.—Paving Elmer avenue, to the Lake Shore Construction Co., $34,745.

Wilkes-Barre, Pa.—The following paving contracts have been awarded: Paving Hickory street with Metropolitan brick, to John E. James, $2.26 per sq. yd., and red stone curb at 75 cents per ft.; paving Hancock street with asphalt, to Warner-Quinlan Co., $2.09 per sq. yd. and 75 cents per ft. for red stone curb; paving Washington street with brick, to John E. James, $2.12 per sq. yd.

Williamsport, Pa.—The following paving contracts have been awarded: West Edwin street, Government Place, North street, Court street, first and second sections, to Busch and Stewart, $2.10 per sq. yd.

Providence, R. I.—The following road contracts have been awarded: North Smithfield and Smithfield, 9 miles, to Amos D. Bridges & Sons, Inc., Hazardville, Conn., $52,714.90; Bristol, 1 mile, L. H. Callan, Bristol, $6,760.75; Burrillville, 1 mile, Amos D. Bridges, $7,139.03; Cranston, ½ mile, Chas. E. Horne, Millbury, Mass., $3,573.22; Coventry, 1 mile, Bristow Bros. & Knowles, Narragansett Pier, $7,528.72.

Fort Worth, Tex.—Paving Twenty-fifth street, to Rudolph S. Blome Co.

San Angelo, Tex.—Constructing 23,000 sq. yds. of creosoted pavement, to M. A. Moon, $2.56 per sq. yds.

Norfolk, Va.—Constructing asphalt paving on Tenth, Thirteenth, Fourteenth and Fifteenth streets and Colley avenue, to the Continental Public Works Co.

Olympia, Wash.—Paving Water and Fifth streets, to the Independent Asphalt Paving Co., Tacoma, Wash., $15,137.58.

Huntington, W. Va.—Constructing the Westmoreland road, to George Hunt, between $3,000 and $4,000.

Milwaukee, Wis.—The following paving contracts have been awarded to the Badger Construction Co.: Galena street, $1.59 per sq. yd.; Cleveland avenue, $1.62 per sq. yd; Forest Home avenue, $1.62 per sq. yd.

Superior, Wis.—Paving Becker avenue, to Sid Riches.

### CONTEMPLATED WORK.

Rock Falls, Ill.—A $6,000 bond issue for paving First street has been voted.

Baltimore, Md.—The city will pave Smallwood street and Monroe street with vitrified brick.

Greensboro, N. C.—A $130,000 bond issue for street improvement, sewerage extension, market and opera house improvement has been voted.

Bartlesville, Okla.—The paving of several streets is contemplated by City Engineer Kirkpatrick.

Houston, Tex.—A $300,000 bond issue for paving construction has been voted.

## SEWERS.

### CONTRACTS AWARDED.

Russellville, Ark.—Constructing a sewerage system, to the Tonkawa Construction Co., Kansas City, Mo., $23,000.

Galesburg, Ill.—Constructing the Mulberry street sewer, to the O'Connor Trading and Contracting Co.

Peoria, Ill.—Paving Chambers street with brick, and constructing a 12-inch pipe sewer in the same street, also curbs, to the Canterbury Bros., $19,554.80.

Woodriver, Ill.—Installing water pipes and sewer mains for the water and sewer system, to Bash & Gray, Joplin, Mo.

Evansville, Ind.—Constructing a sewer in West Delaware street, to the West Side Construction Co.

Council Bluffs, Ia.—Constructing a sewer in Pine street, to the Independent Construction Co.

Ida Grove, Ia.—Constructing a new sanitary sewer system at Galva, to H. Cathroe Company, Omaha, Neb.

Waterloo, Ia.—Constructing sewers on Wellington, West Sixth and other streets, to the Black Hawk Construction Co., $8,700.

McPherson, Kans.—Constructing a sewer, to Elvain & Ramsey, Topeka, Kans.

Fenton, Mich.—Constructing the Fifth street drain, to Bergin & McFadden.

Flint, Mich.—Constructing the Parkland storm water sewer, to William Finley, $22,756.32.

Holland, Mich.—Furnishing materials for the sewer extension on West Tenth and Nineteenth streets, to Tyler Van Landegend, $1,091.68.

Howell, Mich.—Constructing a sewer system, to Hamilton Bros., Bellevue, Mich., $38,900.

Pontiac, Mich.—Constructing a sewerage extension in Ferry addition, to Bergin & McFadden, Flint, Mich.

Duluth, Minn.—Constructing a sanitary sewer on Victoria street, to Johnson & Erickson, $1,500.

St. Joseph, Mo.—Constructing a sewer in district No. 57, to the Kelley Construction Co.

Great Falls, Mont.—Constructing a sewer in Second Alley, to F. E. Evans.

Newark, N. J.—Sept. 10. Constructing the Sixteenth section of the Passaic Valley sewer, including one and a half miles.

Binghamton, N. Y.—The following sewer contracts have been awarded to George Serifina: Riverside Drive sewer, $1,799.95; Hanchett avenue sewer, $216.40. Constructing the Mulberry street extension sewer, to Frank Matthews, $750.

Elmira, N. Y.—Constructing the Mt. Zoar and Herrick street sewers, to John C. Costello.

Guernsey, O.—The following sewer contracts have been awarded: Constructing the Taylor avenue sewer, to Port E. Gibson, $803; constructing the Fourth street sewer, to Stanley & Moorehead, $576.20.

Reading, O.—Constructing a sanitary sewer system, to Thomas P. Strack, $41,774.10.

Youngstown, O.—Grading and sewering Ohio avenue, to the Youngstown Construction Co., $1,347.70.

Erie, Pa.—Constructing a drainage sewer

in the Sixth ward, to Joseph McCormick & Brother, $8,900.

Franklin, Pa.—Constructing sewers in the First and Tihrd wards, to Burns Bros., Newcastle, Pa.

McKeesport, Pa.—Constructing a 15-inch terra cotta sewer on Wayne and Archer streets, to P. F. Rhode & Son.

Philadelphia, Pa.—The following sewer contracts have been awarded: Fifty-seventh street sewer, to Donato Deliso, $4,930; Gunners Run relief sewer in Indiana avenue, to Joseph Lombardi, $70,819.10; Hartwell Lane sewer, to David McMahon, $20,947; Rock Run sewer, to Patrick Durkin, $1,350; Shunk street, to Joseph Lombardi, $50,940; Wissahickon sewer in Stokley street, Robert Higgins, $23,181.86; reconstructing several sewers, to Davis Peoples, $55,000.

Greenville, S. C.—Laying 12,200 feet of sanitary sewerage, to Porter & Boyd, Charlotte, N. C.

Milwaukee, Wis.—The following sewer contracts have been awarded to George E. Zimmerman: Elm street sewer, $3,341.52; Fifteenth street, $1,087.68; Hi-Mount boulevard sewer, $1,799.27; Fourteenth street, $1,900.71; Fifteenth street, $773.90; Forty-ninth street, $1,369.76; also constructing sewer on Twenty-sixth avenue and Arthur avenue, to T. Szukalski, $427.68, and constructing a sewer in Island avenue, to M. Synowitz, $433.20.

CONTEMPLATED WORK.

Nashville, Ga.—A $12,000 bond issue for a sewerage system has been voted.

Mattoon, Ill.—City Engineer C. L. James has prepared plans for a system of storm aand sanitary drains to cost $250,000.

Escanaba, Mich.—An $80,000 bond issue for the construction of a trunk sewer has been voted.

Leonia, N. J.—A $23,000 bond issue for sewer improvement has been voted.

Oneida, N. Y.—Joseph Kemper, engineer, Utica, N. Y., is preparing plans for a sewage disposal plant.

Greensboro, N. C.—A $130,000 bond issue for street improvement, sewerage extension, market and opera house improvement has been voted.

Bend, Ore—A $60,000 bond issue for the construction of a sewerage system has been voted.

Houston, Tex.—A $750,000 bond issue for drainage and a $500,000 bond issue for a sewerage system have been voted.

Kewaunee, Wis.—W. W. Reed, engineer, is preparing plans for a complete sewer system.

## WATER WORKS.

BIDS REQUESTED.

Oakley, O.—Sept. 3, 12 m. Furnishing and laying a 6-in. water pipe in 32nd avenue. Certified check, $50. Oscar Kosche, clerk.

Polk, Pa.—Sept. 4, 12 m. Constructing an electrically operated pumping station and filter plant, with 500,000-gallon capacity. Certified check, $500. Marvin F. Scaife, secretary; Dr. J. M. Murdock, superintendent, board of trustees of the State Institution for Feeble Minded of Western Pennsylvania.

CONTRACTS AWARDED.

Los Angeles, Cal.—Furnishing lights for the Annandale district for a period of five years at $1.60 per lamp.

Alton, Ill.—Installing water pipes and sewer mains in the village of Wood River, to Bash & Gray, Joplin, Mo.

Coffeyville, Kas.—The following water works contracts have been awarded: Furnishing pipe, to the American Cast Iron Pipe Co.; laying the pipe, to McGuire & Stanton; construction work, to F. W. Yale.

Shreveport, La.—Constructing a 100,000-gallon tank and tower for the water supply and distributing system at the fair ground, to the Memphis Steel Construction Co., $2,-900; contract for the pipe line, to the American Cast Iron Pipe Co., $27.40 per ton.

Grand Rapids, Mich.—Furnishing water mains and hydrants for South Front avenue, to Fitzpatrick and Mulvihill.

Mankato, Minn.—Laying water mains on Fourth street, to McLaurin & Northrop.

Hyannis, Neb.—Constructing a new water works system, to C. C. Empfield, $9,000.

CONTEMPLATED WORK.

Kimballton, Ia.—A $6,500 bond issue for water works improvement has been voted.

Lincoln, Neb.—The city will enlarge the municipal water works at a cost of about $45,000.

Honeoye Falls, N. Y.—A $42,000 bond issue for water works improvement has been voted.

Alliance, O.—A $140,000 bond issue for water works improvement has been voted.

Pittsburgh, Pa.—An appropriation of $50,-000 for the construction of a pumping station has been voted. The plant will cost about $230,000.

Winnsboro, Tex.—A $23,000 bond issue for water works improvement has been voted.

Fond du Lac, Wis.—A $25,000 bond issue for water works improvement has been voted.

Rawlins, Wyo.—A $30,000 bond issue for water works improvement has been voted.

## BRIDGES.

BIDS REQUESTED.

Anderson, Ind.—Sept. 7, 10 a. m. Constructing and repairing a number of bridges. Joel B. Benefiel, auditor of Madison county.

Petersburg, Ind.—Sept. 3, 2 p. m. Constructing and repairing bridges. John D. Gray, auditor of Pike county.

Jackson, Miss.—Sept. 5. Constructing the following steel and concrete bridges: New Town bridge, Terry bridge. George W. Sarlls, engineer highway commission.

Cleveland, O.—Sept. 4, 11 a. m. Constructing bridge work under Report No. 2906, including railing, wall, grading, etc. Certified check, 10 per cent. John F. Goldenbogen, clerk, board of Cuyahoga county commissioners.

De Smet, S. D.—Sept. 3. Constructing a slab reinforced concrete bridge. W. M. Look, auditor of Kingsbury county.

CONTRACTS AWARDED.

Oroville, Cal.—Constructing a reinforced concrete and steel bridge, to the Chico Construction Co., at about $12,894.

Morgan Hill, Cal.—Constructing a concrete bridge over the Llagas on Sycamore avenue, to John Doyle, $1,627; also constructing a concrete bridge over the same on Llagas avenue, to William Radtka, $1,-590.

San Francisco, Cal.—Constructing the Niles Canyon bridge, to the Locks Construction Co., $71,460.

Montrose, Col.—Constructing two bridges, to the Pueblo Bridge Co., at $3,700 and $2,-950.

Champaign, Ill.—Constructing a two-span bridge over the Sangamon river at Mahomet, to the Decatur Bridge Co., $7,990.

Livingston, Ill.—Constructing a new steel

and concrete bridge, to the Continental Bridge Co., $1,385.

Pekin, Ill.—Constructing a bridge in Peoria county, to Edward Cooney.

Peoria, Ill.—Constructing a steel bridge across Henry creek, near North Hampton, to Martin Malone, $4,500.

Muncie, Ind.—Constructing five bridges, to the Indiana Bridge Co., and one bridge, to the Fulhart Bridge Co.

South Bend, Ind. — Constructing two bridges, to the Elkhart Iron & Bridge Co., $4,779 and $3,499.

Sullivan, Ind. — Constructing seven bridges, to the Sullivan Bridge and Supply Co., $3,079.

Owensboro, Ky.—Constructing the iron work of a bridge near Hurricane pond, to the Champion Bridge Co.

Baltimore, Md.—The county commissioners have ordered that concrete culverts shall be erected on the following county roads: Hillide, Melvala, Third district; Parsonage, Spook, Eagle Mill, Sixth district; Mays, Belfast, Pot Spring, Eighth district; Worthington, Tupton Church, Fourth district; Wise, Willow Spring, Twelfth district; Beckleysville, Trenton, Benson Mill, Fifth district.

Duluth, Minn.—Constructing two steel bridges, to the Mead Morrison Co., $250,000.

Duluth, Minn.—Constructing a culvert and fill at Eighty-first avenue, West, to C. R. McLean, $13,012.50.

International Falls, Minn.—Constructing the Big Fork bridge over Big Fork river, to Fred Smith, Laurel, Minn., $4,015.

Albany, N. Y.—Constructing the Three Rivers bridge, north of Syracuse, to Barrally & Ingersoll, Rochester, N. Y., $40,639.

Auburn, N. Y.—Constructing the new North street bridge, to the Groton Bridge Co.

Greensboro, N. C.—Constructing a reinforced concrete bridge across Buffalo creek, to the Carolina Concrete Company.

Lima, O.—Constructing the Suthoff street bridge in Delphos, to Jos. Mueller, Landeck, $1,018.

Sandusky, O.—Constructing a bridge in New London, to the Modern Construction Co., Fremont.

Toledo, O.—Repairing thirteen bridges, to R. W. Johnson, and two bridges, to W. J. Demuth, of Whitehouse.

Wooster, O.—The following bridge contracts have been awarded: Emanuel Fair bridge, to Wm. Rockenfeller; Highland Park bridge, to the Central Construction Co.; R. A. Dague bridge, to S. Levers & Son.

East Allentown, Pa.—Constructing the East Mauch Chunk bridge, to the Nelson-Meredith Bridge Co., Chambersburg, Pa., $46,369.

Hazleton, Pa.—The following bridge contracts have been awarded: Butler township bridge No. 2, to G. H. Hartman, $324; No. 3, to the same, $401; Sugarloaf township, Bridge No. 1, to the same, $359; No. 2, to the same, $489.

Pittsburgh, Pa.—The following bridge contracts have been awarded: Rebuilding bridge in Douglass Hollow, to C. M. Driver, $5,047.09; rebuilding bridge in Lovedale Hollow, to J. A. Householder, $3,509.75.

Uniontown, Pa.—Constructing bridges at Stony Fork and Meadow Run and constructing a pier across Big Sandy, near Elliottsville, to W. A. Nelson and Clarence Meyer.

Providence, R. I.—The following bridges were awarded to T. J. Hynes & Son, Wales Mass.: Smithfield bridge, $1,360; Kenyon bridge, $3,560; North Smithfield bridge, $1,150; Noose Neck, $1,750; Millville bridge, $830; Beaver river, $1,960; Foster bridge, $710; Cranberry bridge, $375; Clayville brook bridge, $630; Buck's Horn bridge, $1,125; Portsmouth bridge, $530.

Brownsville, Tex.—Constructing a bridge, to the F. H. Alsbury Co., Houston, Tex., $4,650.

Dallas, Tex.—Constructing a 100-ft. steel bridge across Denton creek, to the Midland Bridge Co., $2,147; constructing three small bridges, to Austin Bros.

Huntington, W. Va. — Constructing a bridge across Big Cabell creek, to the Brackett Bridge Co.

Forest, Wis. — Constructing a bridge across the Sheboygan river, to Joseph Mertes, $1,607.

### CONTEMPLATED WORK.

Manhattan, Kas.—The state highway engineer, at the Kansas Agricultural College, is preparing plans for thirty-five concrete bridges, twenty-four of which will be in Jewell county.

Northfield, Mich.—The construction of two new bridges is contemplated.

Bethlehem, Pa.—The construction of a bridge to cost about $525,000, over the Lehigh river, is contemplated.

Easton, Pa.—The county engineer has been instructed to advertise for bids for rebuilding County Bridge No. 32, over Oughoughton creek, in Lower Mt.

Houston, Tex.—A $200,000 bond issue for bridge construction has been voted.

## GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

### CONTEMPLATED WORK.

Sharon, Pa.—The councils of Sharon and Farrell decided to construct a sewage disposal plant at a cost of about $100,000 to $125,000. C. E. Miller, Pittsburgh, Pa., engineer, has prepared the plans.

## STREET LIGHTING.

### CONTRACTS AWARDED.

Camden, N. J.—Constructing the municipal electric light plant, to Runyan and Carey, Newark, N. J., $1,000.

Cooperstown, N. Y.—Installing a new electric lighting system, to the General Electric Co., Schenectady, N. Y., $25,000 to $30,000.

Cleveland, O.—Installing the electrical equipment for the new municipal electric lighting plant, to W. D. Cook, $18,000.

### CONTEMPLATED WORK.

Duluth, Minn.—Plans have been completed for the wiring of the Aerial bridge for ornamental lights, about 721 lights to each side.

St. Cloud, Minn.—The installation of a "White Way" ornamental lighting system is contemplated.

Johnstown, N. Y.—The city is contemplating the construction of a municipal electric light plant.

## FIRE APPARATUS.

### CONTRACTS AWARDED.

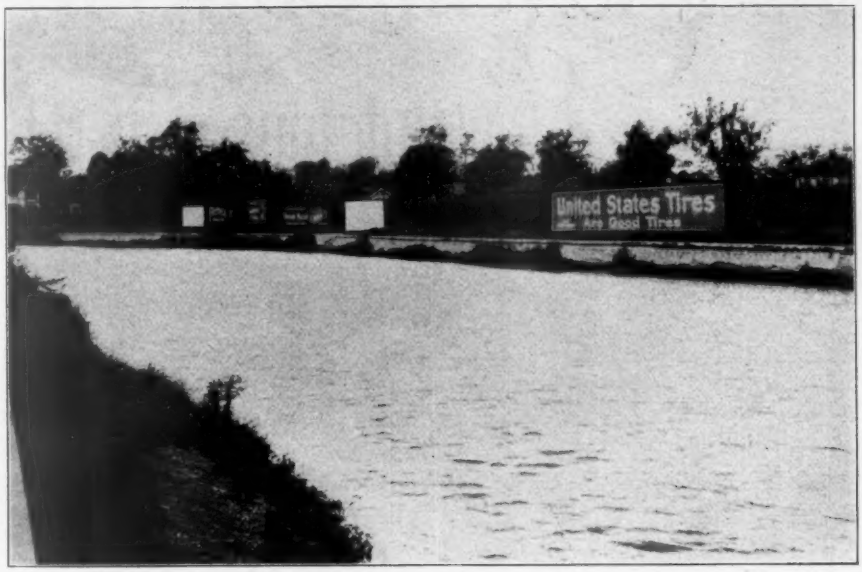
Grand Rapids, Mich. — Furnishing a chassis for the fire department, to the Harder Auto Truck Company, Chicago, Ill.

### CONTEMPLATED WORK.

Champaign, Ill.—The city will purchase near future. Would advise immediate atcombination motor fire apparatus in the tention. Wm. Coughlin, mayor.

Peoria, Ill.—The city will purchase an auto for one of the assistant fire chiefs. The city clerk will advise for bids at once.

# IMPROVEMENT OF STREAM BANKS.




**STREAM BANK BEAUTIFICATION.**
**Showing Billboards and Weeds Along North Side of Fall Creek, Indianapolis.**

**STREAM BANK BEAUTIFICATION.**
**Opposite Side of Fall Creek After the Improvement by the Park Department.**

# The Automobile in

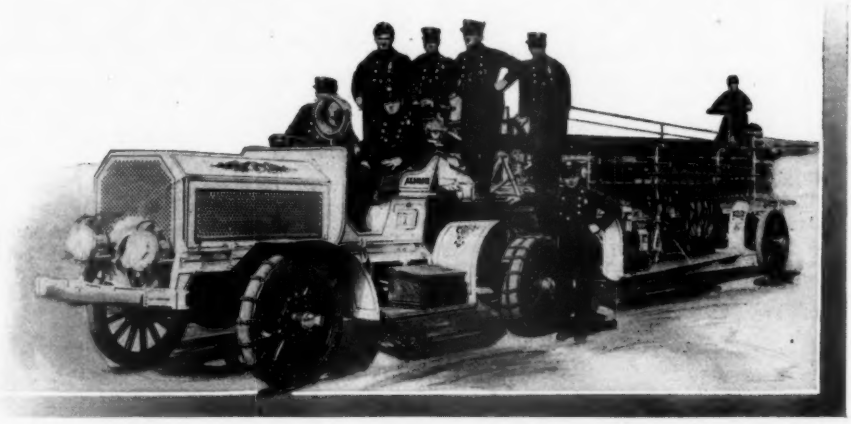
## By R.W. Hutchinson, Jr. M.E.

THE reason for the great movement now going on in American municipalities for the superannuation of the noble horse is due to conditions which have been created within a decade or two by increase of cities' populations, expansion of their areas, architectural changes, enhancement of realty values, extension of distances, congestion of traffic and a variety of lesser causes, which, combined, are making the horse anachronistic in urban communities.

The coming of the motor vehicle into municipal development is already well under way, and its progress in a period of five years has greatly outstripped the ratio of utilization of the motor business wagon in commerce. Day by day the motor-driven fire engine is growing in popularity with municipal authorities; the motor police patrol, the motor ambulance, the motor road sprinkler and road oiler, even in relatively small cities, have grown so familiar as to have lost their novelty. And yet the surface has been barely scratched, when one inspects the statistics for 1912 of municipalities having motor vehicles in operation or contracted for. For every service in which the horse is now employed, the motor, when of the right kind and properly utilized, is more efficient, is cheaper to operate and maintain, and enables centralization to become more perfect, eliminating small sub-stations. In the opinion of the 1911 International Association of Fire Engineers, the horse should no longer be considered by any modern municipality for fire service. The ultimate motorization of fire departments is the ambition of every far-seeing fire expert, and rarely does a fire engineer, without the prompting of ulterior motives, recommend horse-drawn equipment. Enormous monetary losses must surely fall on the municipalities who are buying horse equipment, which, in a few years, can hardly be given away.

The municipal motor vehicle art is so young that naturally mistakes will be made by both manufacturer and user, and only experience and the closest co-operation between city officials and the manufacturers will prevent costly errors to both. The certain future of motor municipal apparatus, particularly the fire engine branch, has attracted a considerable number of builders, some of whom have neither the facilities, the equipment or the experience to turn out apparatus that is thoroughly dependable. On the other hand, the number of manufacturers

# Municipal Service



who have been builders of horse equipment for years and are thoroughly versed in the practical requirements of the apparatus, is large, and their number is increasing.

It is not the purpose here to discuss the design of municipal motor vehicles. Results of the experiences of cities with motor apparatus are the most interesting to municipal authorities, as they reflect the strong or weak points in design and construction better than generalized discussions.

### Fire Apparatus

The motor fire engine is to-day the largest application of power vehicle equipment in use, and, as its field is larger, it is with motor protective and safety apparatus that this article will be chiefly concerned. During the month of May, 1912, contracts for one million dollars' worth of motor fire apparatus were made in the United States by 125 cities and towns. If the motor engine possessed no other advantage than greater dispatch in reaching the conflagration, it would be superior to horses, for saving time is absolutely essential to the effectiveness of a fire department. Seconds and minutes stand for human lives, not to mention the thousands and ofttimes millions of dollars' property loss. It decreases the cost of the department, as when it is not working there is absolutely no expense for keeping it. The centralization of the fire department due to the 50 to 300 per cent. greater radius of motorized apparatus enables the municipality to dispense with numerous sub-stations now situated in sections where property values are increasing and to sell the sites for prices sufficient to motorize the entire department, incidentally complying with their own laws against the establishment of stables in residential sections. For example, the fire chief at Springfield, O., states that the city was enabled to dispense with a building by adding a motor fire engine, a structure which, with site occupied, would have cost twice as much as the new apparatus. Many cities are saving two dollars per day in upkeep cost with motor fire engines.

The following concrete examples of saving verified by the fire commissioners of the municipalities mentioned above proves this statement.

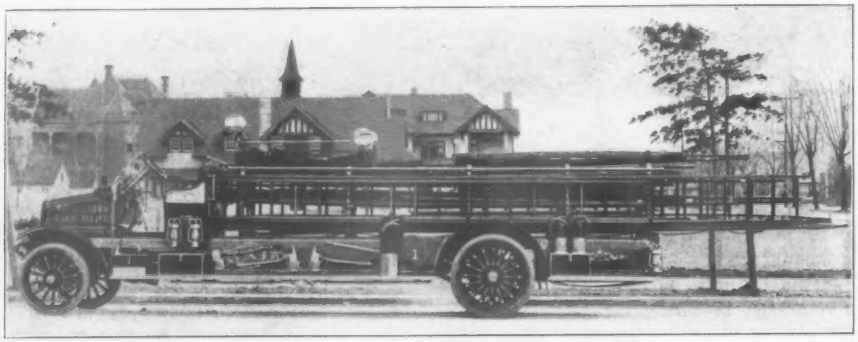
DAILY COST OF MOTOR-DRAWN APPARATUS.

Richmond, Va.....13 cents per day
Springfield, Mass.....14 cents per day
Decatur, Ill.....22 cents per day

DAILY COST OF HORSE-DRAWN EQUIPMENT.

Richmond, Va.....$2.18 per day
Springfield, Mass..... 1.90 per day
Average daily cost from records of various cities.....$2.04 per day

This saving is expressed in dollars and cents, our measuring rule for the efficiency of everything, but one cannot express the utility saving, the protective value of a motorized fire department, in dollars and cents. One needs only to watch the comparative efficiency of horse-drawn equipment and motorized fire apparatus in extremes of weather, particularly in deep snow and sleety pavements, when the horse's drawbar pull is lowered frm 50 to 75 per cent., to appreciate the factor of safety is 100 per cent. greater with the motor engine. Motor fire engines at such times may be the means of saving property worth millions.



THE AUTOMOBILE IN MUNICIPAL SERVICE.
"Mack" Hook and Ladder Truck of Morristown, N. J. Extreme Length, 34 feet. Wheel Base, 18 feet.

### Economy of Motor Fire Engines

As the boilers of steam fire engines become condemned and must be replaced with new ones, fire departments can effect in nearly every case great economies by discarding their steam engines for motor engines. A concrete example will clearly show this. The city of Springfield, Mass., recently had to either overhaul its old steam-driven engines or put in a motor-driven engine. Careful estimates by the city engineer showed that replacement of boilers would mean an outlay of $2,000. To this would have been added a driver's and stoker's wages, aggregating $2,200 per year, and also the upkeep of horses, totaling $500 per year. Thus the cost of a steam engine amounted to $4,700 the first year. A motor engine, by eliminating boilers and horses, stoker and driver (the latter place being taken by an engineer serving in a dual capacity), knocked off $2,200 from the first year's cost.

The city of Minneapolis has a motor-driven fire engine in use which has been put on a scientific cost basis for the past year, in comparison with horse equipment, with the astonishing result that the total expense for the auto engine was $749.58, as against $2,461.50 for the horse equipment, a saving of over 300 per cent. per year in favor of the former.

The small city of Norwich, Conn., has found that the average cost of maintaining a combination auto chemical and hose wagon is $50 per year, against $500 per year for the maintenance of two horses. In one month, which is a fair average, this auto-chemical consumed fifteen gallons of gasoline, costing $2.25, one gallon of engine oil, costing 50 cents, a total expense of $2.75. The number of alarms responded to was 7; miles traveled in practice runs, 25.1; in responding to alarms, 15; total, 40.1.

In Richmond, Va., an auto combination pumping engine, chemical and hose wagon made fifty runs in a period of five months, covering seventy-five miles and pumping at fires for fifteen hours. This service, including gasoline, maintenance,

oils and repairs during the five months, amounted to $20.54. The horse equipment which the motor supplanted cost in a similar period $337.50, or a saving of $317.06 in favor of the motor. In addition, the motor outfit covers 40 per cent. more territory, and is ready to respond to the next alarm immediately it returns from the former, which is not true of the horse steam engine, as the fires within the engine have to be withdrawn, charge relaid and the engine put in serviceable condition.

Cost data of this kind could be multi-

### Police Patrols

The first motor police patrols used in America began to appear in 1905. During the past seven years the employment of patrol automobiles has multiplied to such an extent that there is hardly a city of 100,000 population that does not own at least two much machines. The advantages of motor over horse patrols are in the main the same as apply to motor fire apparatus, the elimination of enormous maintenance expense incident to horse-propelled patrols. The economies are most strikingly shown when combination

THE AUTOMOBILE IN MUNICIPAL SERVICE.
Motor Trucks on Road Construction.

plied to fill an entire issue of this magazine, but space prevents, and the figures would merely make more emphatic the voluminous evidence presented of the economy of the mechanical fire vehicle. A press item which the writer recently saw from Salina, Kans., is so typical of the efficiency of the auto fire engine that I will give it in full: "An alarm was recorded at 8:59½ a. m. At 9:02 a. m., 150 seconds later, the machine had covered the distance, more than a mile, 100 feet of hose had been laid, the water turned on and a stream playing."

auto ambulance patrols can be used. For example, the commissioner of public safety of a certain city informs the writer that the cost of each of two separate horse-drawn vehicles is as follows:

| | |
|---|---|
| Salaries of three policemen per month (patrol and ambulance drivers) | $225.00 |
| 3 horses (feeding, shoeing, etc.) per month | 97.50 |
| Repairs on 2 wagons from Jan. 1 to July 1, 1912 | 194.62 |
| Total expense for 6 months | 2,129.62 |

In addition, this commissioner says he has two worn-out wagons left at the end

of this period. Contrast these figures with the operating expense of a combination auto ambulance-patrol (for one year):

| | |
|---|---|
| Tires | $378.00 |
| Gasoline | 262.00 |
| Oil | 23.50 |
| Driver and ambulance attendant | 1,800.00 |
| Repairs | 125.00 |
| | $2,588.50 |

Assuming that the expense of the horse patrol and ambulance (two vehicles) was double the above figure ($2,129.62) in one year, or $4,259.24, the combination auto apparatus is saving the city $1,671 per year, a sum that will more than pay for the machine in two years. Motor police patrols are saving cities from $250 to $1,500 per year each (on an average) over horse patrols, from carefully computed figures which the writer has verified.

THE AUTOMOBILE IN MUNICIPAL SERVICE.
A Seven-Ton "Mack" Truck Distributing Asphalt for City Paving in Seattle, Wash. The Body Is Lined with Fire-proof Material.

### Road Repair

Those who have made a careful study of economic road maintenance have generally conceded that the neglect on the part of cities, towns and townships to repair their roads promptly has brought about a very excessive cost for this maintenance work. It is generally accepted as a truism that $50,000,000 is being spent for road building in the United States every year and $100,000,000 is expended for their maintenance.

If two men with the proper equipment were kept constantly employed going over the roads in their territory, equipped with material and tools with which to properly repair trifling defects, the annual expense of such repair work would be considerably less than if the plan of periodical work were employed. From all information obtainable, it appears that a new piece of road is generally allowed to take care of itself for the first year or two, at the end of which time the neglect to repair properly what were originally trifling defects has allowed the road to get in frightful disrepair, requiring a very considerable sum to restore it to its former condition.

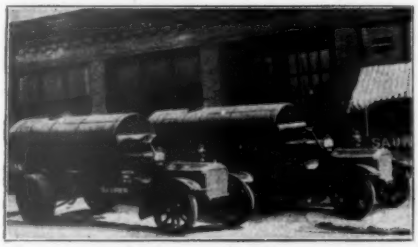
Very many miles of road could be taken care of by a motor truck operating daily and covering all of the roads in the care of the city where it is to work. This truck could be provided with changeable bodies, one of these bodies to be of box construction to carry sand, gravel, crushed stone and top dressing, as might be required; at other times, tar kettle and material for building roadside fires. The other body could be for water for sprinkling during the summer months.

The former equipment could be generally used during the winter months and the sprinkling body placed on the chassis for summer use. A small hole or rut worn in a road, if neglected, will have its sides gradually torn down by continuous traffic, and develop into a large hole, requiring the expenditure of a considerable sum to effect proper repairs.

With the advent of the motor truck we believe that the business men in every community have come to realize the importance and economy in maintaining good roads.

### Motor Dump Truck

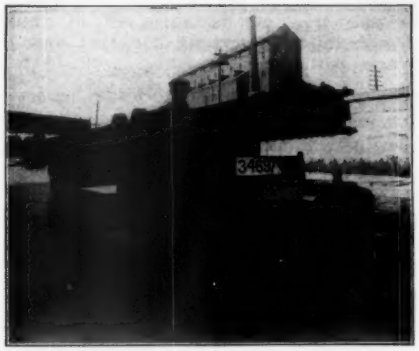
The economy and great utility of the motor dump truck to municipalities for street construction and maintenance has been proved in every city where it has been given a fair trial. Motor dumping trucks are made with either side or end discharge bodies, the latter being the most practicable type, as it permits broken stone, sand, asphalt or dirt to be spread to a uniform depth through the tailboard, the extent of the opening of which is governed (see illustration) by a chain about the bottom of the tailboard fastening it to the platform of the body. The operation of this type of dump truck is entirely automatic and under the control of the truck driver. As the truck moves forward it leaves in its wake a spread of even depth and width. This element of labor saving cannot but appeal



THE AUTOMOBILE IN MUNICIPAL SERVICE.
Motor Road Oilers Used in Kansas City, Mo.

strongly to the street and highway commissioner, who sees with considerable satisfaction the truck perform gratis, and in a few seconds, the same labor that heretofore has taken hours to accomplish by hand, with the attendant expenses.

One of the most noteworthy examples of the economy of the motor dump truck



THE AUTOMOBILE IN MUNICIPAL SERVICE.
A 5-Ton Truck Carrying a 50-Foot Girder for the New York Municipal Building.

for municipal service is shown by the experience of Rutland, Vt., of which Mayor Clement says: "On one piece of road we moved and spread with the truck (a 7-ton Mack machine) over 2,000 tons of broken stone in 17½ days, a distance on an average of 1½ miles—an average of about 114 tons a day at a daily cost of $5. If the same work were done by teams it would require at least twelve teams, costing in this city $4 each." In other words, this truck is saving the city of Rutland $43 per day in road building. Reflect for a moment the saving which could be made in a thousand towns and cities in the United States on the same basis as this truck has done.

### Road Building

The city of Mount Washington, Md. (suburb of Baltimore), has recently completed a stretch of macadam road which was built with a 5-ton automatic motor dump truck and a four-mule team. The operating report of motor vs. mule equipment shows the following interesting figures:

| | |
|---|---|
| 4 mules at $325 each | $1,300.00 |
| Harness | 75.00 |
| Wagon | 250.00 |
| | $1,625.00 |

MULES.

| | |
|---|---|
| Interest on half investment at 6 per cent. | $48.75 |
| Insurance on truck, 2½ per cent. on 80 per cent. of half value | 2.50 |
| Insurance on team | 32.50 |
| Depreciation, 20 per cent. | 325.00 |
| Fixed charges per day | 1.85 |
| (Assuming 225 working days per year.) | |
| Wages per day | $1.84 |
| Feeding at 60c per head | 2.40 |
| Stable man | .25 |
| Veterinary's service | .20 |
| Shoeing | .30 |
| 140 days' feeding at 40c per head, $224 | .99 |
| Total daily operating cost | $6.18 |
| Fixed charges per day | 1.85 |
| | $8.03 |
| Truck | $5,300.00 |

TRUCK.

| | |
|---|---|
| Interest on half investment at 6 per cent. | $159.00 |
| Insurance on truck, 2½ per cent. on 80 per cent. of half value | 53.00 |
| Depreciation on truck (not including tires) | 480.00 |
| Fixed charges per year | $692.00 |
| Fixed charges per day | 3.07 |
| Maintenance, .04½c per mile | $2.50 |
| Tires, 6c | 2.70 |
| Gasoline, 4c | 3.60 |
| Oil | 2.40 |
| | .60 |
| Total daily operating cost | $11.80 |
| Fixed charges per day | 3.07 |
| | $14.87 |

Four-mule team hauls 13½x4½, or 57.37 ton-miles per day: 13.9c per ton-mile. (The discrepancy in ton-miles is due to the mules not working, quarry being shut down owing to cold weather.)

Five-ton truck hauls 5x30, or 150 ton-miles per day: 9.9c per ton-mile, or a saving of 4c per ton-mile, or $6 per day.

The truck had to make ten miles to a round trip, as against nine for the team, on account of having to go a mile out of the way on the trip from the quarry in order to avoid a bridge, which was too weak to carry it loaded. One mile of the trip loaded was up a 14 per cent. grade. The average amount of gasoline consumed was twenty-one gallons. Average amount of oil consumed was two gallons. Average working hours was ten. Average time loading, 3 minutes; average time unloading, 10 minutes. Total load carried, 60,000 pounds; number of trips, 6; total mileage, 60. There were three rainy days during the test, so that most of the time the roads were soft and in bad condition.

### Street Cleaning and Garbage Removal

American municipalities have been comparatively slow in taking up motor truck apparatus in their street and sanitary engineering departments, primarily because the motor manufacturers have not until very recent years devoted attention to the development of body designs suitable for municipal service. In Europe the motor-driven road sprinkler, road oiling machine and motor garbage wagons have been in service for several years, and European municipalities have developed the use of motor truck apparatus to a high degree of efficiency. For instance, in Rouen, France, all street cleaning apparatus is of motor-driven type, and economies as great as 66 2/3 per cent. over former horse equipment are reported. In New York City Commissioner Edwards is now experimenting with motor garbage carts, and reports that the cost by former equipment was as much as 80 cents per ton of garbage removed, whereas the motor trucks have shown cost of but 23 cents per ton. The number of American cities using motor garbage carts on a very small scale, however, can be counted on the fingers of one hand. For house-to-house collection, the gasoline motor garbage cart is unsuitable, as frequent starts and stops do not enable the gasoline motor to operate economically.

### Street Sprinklers

Motor-driven street sprinklers in which the gravity principle is utilized and similar in design to horse truck wagons have been in use for four or five years, but their application, for some reason, has been relatively slow.

Pressure regulated sprinklers, in which a double-acting water pump is worked by the driving engine of the sprinkler, are coming into vogue, and offer decided advantages over the gravity type, due to better control of the area to be sprinkled and more uniform distribution of water. In Europe motor-driven sprinklers discharging from the front instead of the

rear of the machine are more popular. St. Louis is the only American city employing a sprinkler of this type. This sprinkler (see illustration) is mounted on a 6½-ton chassis of standard construction. The riveted tank, which is 4½ feet in diameter and has a capacity of 1,400 gallons, is mounted on a cradle and "guyed" with cross-stays provided with "turnbuckles," so that shifting is impossible. The most novel features of the device, however, are the double-acting force pump, which, driven by the motor, forces the water thru the nozzles; and the location of the nozzles themselves, about a foot in advance and on either side of the motor hood. This location was adopted so that the truck itself would not cause the very evil it is designed to cure; the forward position of the spraying apparatus wets down the street in advance of the wheels, so a cloud of dust is not raised as a preliminary to the dust-laying.

It is claimed that a roadway from 70 to 80 feet wide can be sprinkled at one operation, and at any rate over 10 miles an hour, which naturally is quite beyond the scope of the horse-drawn sprinkler.

### Street Sweepers

A great opportunity for the development of pneumatic motor street sweepers exists in the United States, but few practicable types are yet on the market, and these have had but little application. The vacuum type, utilizing the principle of the household vacuum cleaner, is being experimented with in New York and several other large cities, but is too cumbersome in its present form. Its future, however, is promising. An Indianapolis inventor has recently put out a pneumatic type of motor-driven sprinkler in which the general plan is that the air used for sweeping is recirculated, being used over and over again, with the exception of the small leakage. The sweeper is worked by a suction fan, and is equipped with small boiler, which serves a double purpose. Steam, added to a centrifugal separator mounted over the dirt receptacle, entrains the dust particles and aids in the separation of dust from solids, and it also dampens the mass so that dust is prevented when dumping. The sweeping fan is driven by a gasoline four-cylinder engine, thru a cone clutch and spur gears running in oil. The maximum speed of travel is 5½ miles per hour. Two men are required to operate it; one controls the steering, fan speeds, etc.; the other controls the pressure in the air system, raises and lowers the dust hood by levers, fires the boiler and dumps the dirt. This machine has swept, under test, 125 blocks, or about 6½ miles of street per day.

THE AUTOMOBILE IN MUNICIPAL SERVICE.
A Pressure Regulated Motor Sprinkler of 1,400 Gallons Capacity Used in St. Louis, Mo.

# A PROBLEM OF THE GROWING CITY.

By Albion Fellows Bacon, Evansville Ind.

THE Growing City" means hustle and push, enterprise, growth of commerce, increase of wealth. But, fundamentally, it means a growing population, for we are judged by our census, first and last.

The problem of the growing city is, therefore, the problem of providing for an increasing population. As the first and simplest civic need of those who come to a city is for shelter, and as every newcomer is a veritable "home-seeker," the housing problem becomes the most urgent one of the growing city.

ALBION FELLOWS BACON.

It is the intent of this article to show that the housing problem is not for the housing reformer alone, but is for the city planner, the civic improver, the municipal engineer; in fact, all who work for the improvement of cities. The oft-stated principle of social service that "the relation of all social evils calls for the correlation of all remedial agencies" is a principle that might well be applied to civic effort. Certain it is that we must extend our vision beyond the customary limits of our specialties, to take in this, or any other great civic problem, as a whole.

Because the housing problem is too often left to the housing reformers, that does not argue that it is his exclusive job. It only shows the weakness of the civic policy that goes on making more housing reformers necessary.

It should be remembered that the housing problem of a city takes in much more than the cure or prevention of slums. It has to do with all the housing of all the people, and one of its most serious factors is the frequent inadequacy of the supply of dwellings for present needs, as well as for future growth.

It should be remembered, too, that the lack of city planning and municipal engineering has given a great deal of occasion for housing reform, and forces upon the housing reformer many things, outside of house construction, which would have been prevented by the timely employment of the other experts. The greatest point of contention, in securing housing laws, is sufficient lot space to admit light and air to the required windows of new, as well as of existing buildings; and the meager spaces that are won, after long and hard battles, contrast with the generous allowances of the city planner.

The next hardest battle must be fought to get water, drainage and sewerage, with proper plumbing, especially in existing houses, and to attend properly to all disposal of waste, and all occasion for filth. The fact that water and sewer mains are not laid to the end of all streets, but that buildings precede them, and that even tenements are built in the outskirts thus unsupplied, makes more trouble for the housing reformer. His mission being to make dwellings sanitary, fit and safe for habitation, much of his attention must be spent on plumbing, the abolition of cess-pools, the prevention of damp floors, wet cellars and on a water supply, etc.

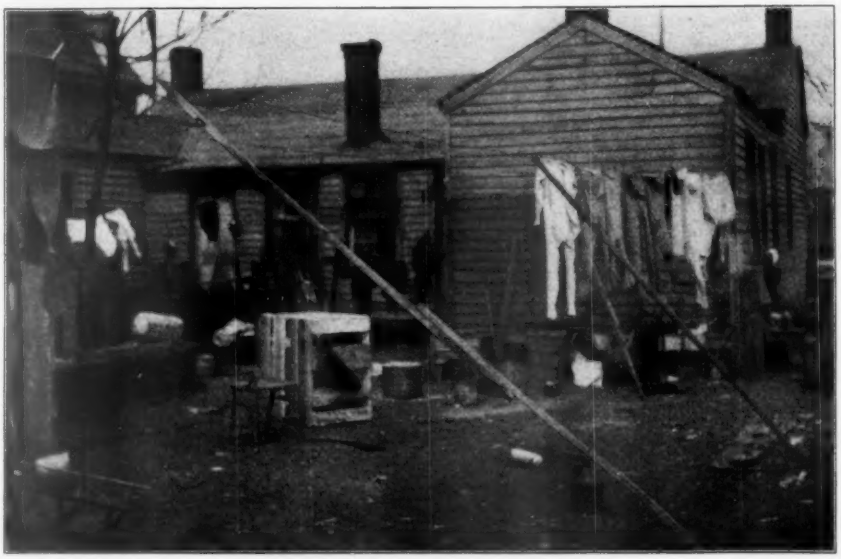
### The Value of Sanitary Maps

Nothing but a sanitary map of our cities, such as Dr. George Thomas Palmer, made of Springfield, Ill., would convince the public of the amazing number of lots in a large number of our cities, which are without water and sewer connections. By marking such lots black, on the map, the showing is striking and conclusive. The most astonishing fact that would be proven, in many cities, is that the black spots are distributed all over the map,

and are not confined to any poor district. But maps, figures, photos, words, all fail to give any idea of the sights and smells that these black spots designate, or the misery and sickness they too often stand for.

The worst feature is the old vault or cess-pool, which, covered by a decaying shed on the rear of the lot, is a blot upon civic beauty, poisons the air of the whole neighborhood, breeds swarms of flies, and, in many cases, pollutes the water of the cistern, which is in some places the only supply for one or a dozen families, by seepage. With no sink on the premises, suds and dish water are thrown upon the yard, where they stand in slimy pools till a scum forms, or trickle in an offensive sluggish stream to join the other filth of the alley. The water thus thrown out also seeps into the cistern, which, having no pump or cover, is also full of floating trash. It is not uncommon to find several families, using out of such cisterns, having cases of typhoid fever in each family. Much of the sickness of our cities, and much of the infant mortality, may be traced to these conditions. The lack of water, and the means of disposing of waste, necessarily means filth, and filth is one of the chief causes of the slum.

While it is true that cisterns or wells are not used in some cities, and the water supply is all piped, it is equally true that landlords refuse or neglect to supply water, very often, and the occupants of a whole tenement will be found carrying water a square or more from a public fountain. Or, several families will be forced to use one yard hydrant in common. But in the smaller towns the polluted cistern and the cess-pool, with the sodden yard, give to urban life only an intensification of rural inconveniences and lacks.



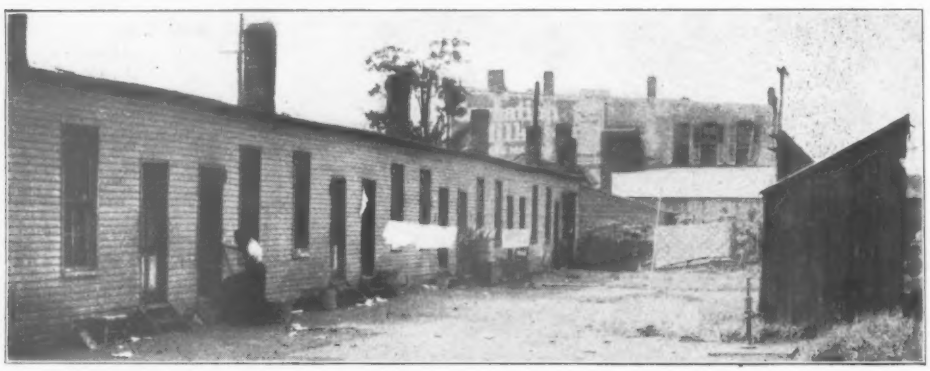
THE PROBLEM OF A GROWING CITY.
Rear of a "Double" in a Middle Western City. Note Unsanitary and Unsightly Surroundings Among Which the Women Work. Rents for $14 a Month.

### Housing Laws Must Be Improved

With such conditions the housing reformer must contend, as well as attending to house construction. In this work, too, he has much to hamper him. As housing reform can be secured only by compulsion in all but rare instances, strict laws are needed for this purpose, with strong enforcement, and everlasting 'vigilance to prevent their evasion.

It is not fair to presume that the housing laws, which have been secured only after long and bitter legislative battles, represent the ideals of those who drafted them. In too many instances, all that can be required is the merest minimum necessary for health and decency. Light and air, water, drainage, sewerage, privacy, fire protection, necessary repairs, disposal of garbage, such are the things for which the housing reformer fights! Not beauty, not conveniences, not even comfort would he dare to give as a requirement in asking housing laws. Yet it is the hideous ugliness of the slums that often drives the housing reformer to his work, and it is a vision of the waste places redeemed, of the beauty that shall be given for ashes, that keeps him at his task.

THE PROBLEM OF A GROWING CITY.
A Thirteen Suite House in a Small Western City. Three Rooms to a Suite; the Middle Room With no Outside Air or Light.



THE PROBLEM OF A GROWING CITY.
Rear of the House Shown Above. Note the Single Pump Which Supplies all the Suites, and the Fact that the House is Built Flat on the Ground.

Housing reform is no clean-cut problem of engineering. It differs from these as organic chemistry differs from inorganic. It is a mixed social and civic problem. Faults of location and construction make bad housing. It takes people, with all these, to make slums: the landlord and the tenant, neglect, overcrowding, filth.

**The Great Problem of the Growing City**

Lest it be thought, from this talk of housing reform, that this article applies only to large cities, we hasten to say that every growing city in the country is included. Every one of them has a housing problem. Moreover, reports of the last two years show that not only our great cities have slums, but they exist in most of our towns, and in many of our villages. We are just waking up to the fact that they have been with us for a good while, only they had never been diagnosed. We didn't know a slum when we saw one.

We thought slums were the exclusive property of great cities. We listened aghast to Jacob Riis's stories of the New York slums, of the dark, foul, crowded tenements, where unutterable wretchedness and crime made existence hideous, and we were so thankful that we didn't have slums! It is like being thankful that we haven't any heathen, because we don't live in China. We simply did not realize that as "pigs is pigs," anywhere you find them, so "slums is slums," on the edge of a village or in the heart of a great city. We thought that land congestion was the only congestion there was. We had to learn that "room congestion" is the very worst and commonest kind, and makes the worst type of slums.

Nothing but the "personal touch" of the actual thing can give an adequate conception of the horrors of "room congestion," with a whole family, or perhaps two families, crowded into one room, that room already being full of beds and other articles of furniture, including a cooking stove. Hundreds of families, in even moderate sized towns, live in this fashion. Hundreds of others live in two or three rooms. The commonest type of a slum quarter is the "converted house," which is oftenest an old residence, built for one family, and rented by eight or a dozen. The common use of the one hall and stairway, the yard, cistern and yard closet, is one great cause of vice in the slums.

It is not unusual to find from five to ten people living in two rooms, one of which has no window, the sleeping room, of course. Fifteen to seventeen people have been found in two rooms, and a family of twelve in one room. The foul odors and filth, due to lack of ventilation, lack of water and sewerage, and to overcrowding, can hardly be imagined, and would not be dwelt upon only that we wish to call special attention to these conditions, as they are important factors in the housing problem, and have to do with the growth of the city.

The significant fact on which we wish to dwell is this: that not only the poorest classes are found in such abodes, but too often our working men's families are housed in this miserable manner. The scarcity of decent houses, in some of our cities, forces our workmen, who could afford comfortable homes, into the crowded tenements, or, if not in the same building, into slum neighborhoods. Here their families are exposed to both physical and moral contagion from association with the vicious and degraded, and from the unsanitary surroundings. Here the rosy children, brought from the country or the village, grow sickly and pale, and the older boys and girls learn the allurements of the street. Home life is impossible, with the lack of comfort, convenience and privacy, and the family standards are gradually reduced.

It is bad enough in the case of our American citizens, who can speak English, and have some chance of protecting themselves. The outrage of our cities is the way we serve ignorant foreigners, who, being the easy prey of the unscrupulous, are charged high prices for sub-let rooms, where they are crowded like cattle, amid the filthy and degrading surroundings.

THE PROBLEM OF A GROWING CITY.
Three Persons Exist in This Ruin.

### Overcrowding Is Expensive

It is to the rivalry among our growing cities, to get big quick, and to get rich quick, that much of this overcrowding can be charged.

To get more factories seems to be the ruling passion, so factories are bid for and brought in. Working men have to be imported to operate the factories, so they are brought with their families by the score. By the flourish of a pen, hundreds of citizens are added to our numbers, when, perhaps the city cannot provide for

all it already has. Hundreds of children are transplanted from one soil to another, perhaps to a deadly environment. Human lives, human souls, are poured, as from one vial into another, as lightly as a chemist pours his drugs. If we had decent homes for all who come, as good as they could afford to pay for, we might take honestly this great responsibility of human health and welfare. But already our old tenements, hovels, warehouses, even stables are crowded full, in many places, already the problem is beyond our control. Yet we continue to draw in more, crowding them into the human coops that we call houses.

All over the United States this is happening. Normal families are being forced into subnormal environment. Too often, in the course of time, they sink to the ranks of the delinquent or dependent.

Much of the gold that the added industries bring in is paid out for the added cost of dependency, crime and disease. Our civic growth is unhealthy, for we grow diseased and rotten at the core. The citizens we have brought in are too often a drag upon civic progress, and we have not even the gain we are working for.

These results are supposed to be met by charity, philanthropy, housing reform and by various civic doctors and surgeons. It is first of all a problem for the commercial clubs. If they bring people to a town, they are responsible for them. Yet so often they wash their hands of all responsibility, after the bonus is paid and the factory is landed. In about forty of our cities, however, commercial clubs are taking up housing reform, and other cities are being added to the list. This shows that business men are waking up to the fact that the housing question is a business proposition, involving the depreciation to real estate in slum neighborhoods, the public cost of typhoid, tuberculosis, and other diseases prevalent in the slums; also that they are waking up to the commercial value of the working man, whose health and efficiency are jeopardized by bad housing.

This is a most hopeful sign, for when the men who manage the business of our cities are fully impressed by the commercial aspect of the housing problem, we may expect all of its phases to receive their attention. This means that housing reform will be followed by the building of new houses, in a well planned effort to provide for the needs of the growing city.

How this is to be done is a matter for the business men to decide, with the help of civic experts. From the semi-philanthropic plans of providing good and cheap houses for the working man, to the schemes of the speculator who develops suburbs and builds groups of houses solely to make money there is a broad range. We have faith that our business men, working the problem out with the aid of municipal experts, will before long come to a practical demonstration of the fact that lives are worth more than land, that there is plenty of room on the outside, and that every citizen must be given a legal right, as he has a moral right, to sunlight and air. With this right established, convenience, comfort, beauty, will follow. But the housing reformer, looking wistfully over the Land of Promise, must stop in the desert, content to have in his keeping the tables of the law that are to hold back the tribes of men from civic sins. It is his part only to exact that every new dwelling shall have in it no lurking seeds of death.

But with each extension of building lines, the housing reformer faces another difficulty. City laws extend only to city limits. Unless those limits are given timely extension, or unless suburbs are built up under wise restrictions, as to lot spaces, sewerage, etc., all sorts of housing evils may be expected. There is no need to cite examples of cities whose suburbs are a menace to the whole municipality. This is especially true of those cities whose slums form veritable "ragged edges" and are spread over outlying districts of hovels, like leper colonies. The greater danger of our colonies is that they do not remain afar off, with the warning cry, "unclean," but they mix with the life of the town itself as freely as if under its laws.

# FIRE DEPARTMENT MOTORS OF BIRMINGHAM, ALA.

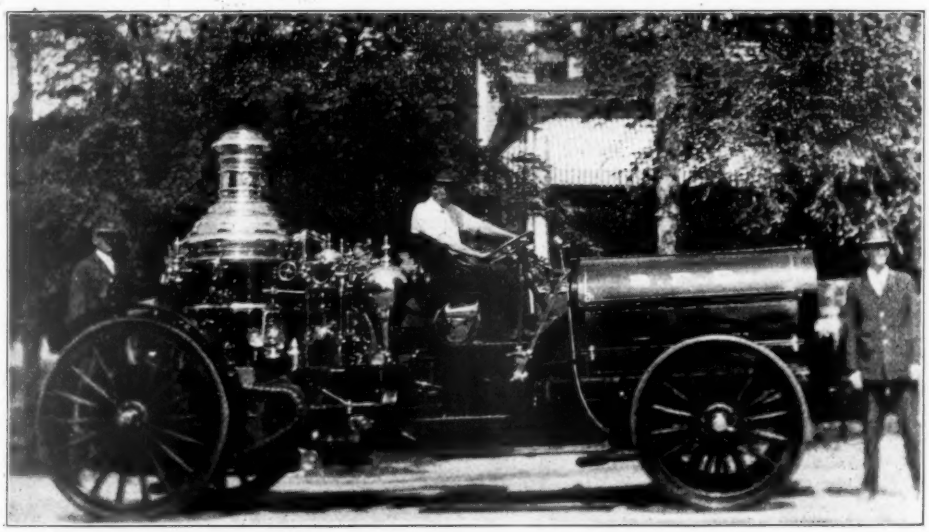
By Maury Nicholson, C. E.

ON January 1, 1910, Birmingham absorbed by extension of its boundaries, nine separate and distinct cities, and increased its area from seven to fifty square miles, the outline of the new boundary being approximately that of a large bird in flight, with a spread of fifteen miles from tip to tip of its wings, and four and one-half miles from head to tail, and taking flight in a northwesterly direction over a series of parallel valleys and ridges from the crest of a mountain range extending northeast and southwest. The nine absorbed municipalities varied in size and age from a corporation eighteen months old with less than 1,000 population to one twenty years old with more than 10,000 population, and topographically from swamp to mountain with a correspondingly varying degree of development in the organization and equipment of their fire departments. To assimilate all these various conditions, organize them into one efficient, economically working department was the proposition that Fire Chief A. V. Bennett had to handle.

The two factors of financial resources and expanse of territory controlled the solution of the problem, and as the city's income is limited to 1 per cent general tax rate, eked out by a schedule of high license, the fire department's proportional share of this income reduced the financial resources almost to the impossible point, when the extremely large territory that must be protected and its physical conditions were taken into consideration.

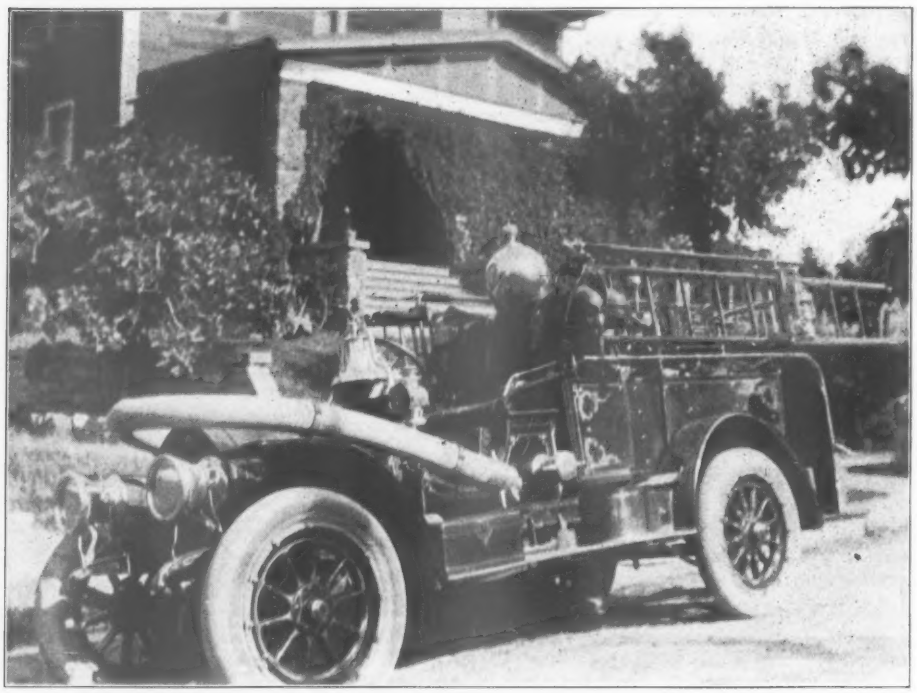
Speed, endurance, reliability and power was the combination of qualities needed to meet the transportation requirements, while low cost of operation and maintenance with reasonable first cost were required to meet the financial resources. The fulfillment of all these conditions demanded an equipment of the highest efficiency, designed and developed and tried out to meet such physical demands. The logical result of the full appreciation of these facts was the investigation of motor fire apparatus as representing the most advanced ideas and intelligent efforts of manufacturers and expert fire fighters.

This investigation and study covered a considerable period of time, a wide field of experience in other cities, a number of practical tests of different makes and



THE FIRE DEPARTMENT MOTORS OF BIRMINGHAM, ALABAMA.
A Steam Fire Engine Adapted to Motor Drive.

types of motor fire fighting apparatus, and led Chief Bennett to the conclusion to recommend the equipment of the entire department with motor apparatus as rapidly as it could be done. This recommendation was concurred in, first by the board of aldermen and later by the board of commissioners of the city when the commission form of government went in effect, and the motorising of the department began in October, 1910, by the purchase of two combination, 4-cylinder, 50-horsepower A. L. A. M. rating combination chemical and hose cars.



THE FIRE DEPARTMENT MOTORS OF BIRMINGHAM, ALABAMA.
Gasoline Pumping Engine and Hose Car.

At this time the department was composed of sixteen stations, That territory served by No. 3 is the only portion of the city where it is necessary to supplement the hydrant pressure over the entire area served with pumping, and this being a high-priced popular residence section, well built up over its entire area, which reaches from the foot to the crest and along the side of Red Mountain for a distance of two and one-half miles, it was necessary to equip this station with apparatus to meet these conditions. This was done by taking a discarded second size Ahrens steam fire engine and having it rebuilt and motorized into a 4-cylinder, 78-horsepower motor fire engine, which was, when installed, the second of its kind in the United States. This, supplemented with a 6-cylinder, 79-horsepower combination chemical and hose car, carrying one 40-gallon chemical tank, 200 feet of chemical hose, 2,000 feet of 2½-inch rubber lined cotton hose, one 25-foot extension ladder, one 12-foot roof ladder, two 3-gallon hand extinguishers, axes, crow-bars, etc., completed the apparatus equipment for this station. The remaining stations except as noted were equipped with the combination chemical and hose cars, which replaced all horse-drawn apparatus, except steamers and aerial trucks. The territory served by station No. 11 has some high sections in which it is necessary to supplement hydrant pressure with pumping; this section is, therefore, equipped with a triple combination chemical and hose car, having rotary pumps

of 750 gallons per minute, estimated capacity. This car is a 4-cylinder, 52-horsepower A. L. A. M. rating, carrying one 40-gallon chemical tank. Station No. 13 has a similar equipment to station No. 11, as it serves a territory that is supplied with water from a small separate system, which does not give sufficient hydrant pressure to make pumping unnecessary. All the other stations serve territory in which the hydrant pressure makes pumping unnecessary and they are, therefore, equipped with combination chemical and hose cars.

The motorising of the department has extended over two years, and at present the total motor equipment consists of twenty-one pieces of fire apparatus and a car each for the chief and first assistant, described as follows: Twelve 4-cylinder, air-cooled, 52.9-horsepower, combination chemical and hose cars, equipped with one 40-gallon chemical tank, 200 feet of chemical hose, 1,800 feet of 2½-inch rubber lined cotton hose, one 25-foot extension and one 12-foot roof ladder, two 3-gallon hand extinguishers, axes, crowbars, etc.

Six 6-cylinder, air-cooled, 79.3-horsepower combination chemical and hose cars, equipped with one 40-gallon chemical tank, 200 feet of chemical hose, 1,000 feet of rubber lined 2½-inch cotton fibre hose, one 25-foot extension and one 12-foot roof ladder, two 3-gallon hand extinguishers, axes, crow-bars, etc. The motor is of the air-cooled type, 6-cylinder, with 5¾-inch bore and 6-inch stroke, developing 79.3 horsepower, according to the A. L. A. M. rating.

Two 52.3-horsepower, water-cooled, triple combination machines, equipped with one chemical tank of 40 gallons capacity, 200 feet of chemical hose, 1,000 feet of 2½-inch rubber lined cotton fire hose, one 25-foot extension and one 12-foot roof ladder, two 3-gallon hand extinguishers, axes, crow-bars, etc. These machines are also equipped with rotary pumps with an estimated capacity of 750 gallons per minute.

One motorized steam fire engine. This is a second size Ahrens steam fire engine rebuilt and equipped with a 78-horsepower motor. All horsepower is according to A. L. A. M. rating.

This equipment represents an investment of $80,000, and a monthly interest charge of $333.33. At the present time it is impossible to give a detailed comparison of cost between the motorized and horse equipment that would not be misleading, owing to the comparatively short time the motors have been in use, and the fact that the firemen have had to acquire in this short period the radically different knowledge and skill demanded for the proper care and operation of the machines. An intelligent and accurate comparison of the two can only be made by a study of carefully compiled records kept for a period of five or six years. Chief Bennett states, however, that even the short period the motors have been in use has demonstrated their superiority over the horse equipment under the existing conditions; in the greatly increased territory that can be protected by one station and the consequent reduction of the number of stations necessary to protect the whole city.

An examination of the department records for February, 1912, which is taken as an average of the heavy work months, shows very clearly how the physical conditions of the streets over which runs are made affects the cost of operating the cars. The cost varies from 4 3-10 cents per mile at station No. 1, that answered 53 alarms and traveled 65.2 miles over paved streets and low grades, to station No. 13, answering 2 alarms and traveling 7.2 miles over unpaved streets and steep grades, at a cost of 16 cents per mile. The cost in both cases being for gasoline and oil only. All necessary data concerning cost of operation and maintenance are being compiled so that at the end of a period of five or six years a complete and intelligent comparison of the relative efficiency of the motor and horse equipments can be made. The change from horse to motor power is a logical step in the process of evolution brought about by necessity, and it must undergo the test of the law of survival of the fittest before the last word is said.

# AUTOMOBILES OF SPRINGFIELD, MASS.

By Joseph H. Bay, Springfield, Mass.

THAT motor-driven apparatus is an economy, compared with horse-drawn vehicles, has been clearly demonstrated during the last decade, with the result that few cities in the United States now are without at least one automobile in some one department, but it remained for Springfield, Mass., to take the initiative in introducing fire-fighting autos and following up its own example by applying this principle of economy and efficiency, until now the city owns thirty-eight motor-driven pieces of apparatus, leading, in comparison, the entire world in its municipally owned machines.

It was back in 1904 that the city decided to try its first experiment with an auto, in the form of an auto police patrol, and within a few months the street-lighting department purchased a small runabout for its superintendent. Another few months brought forth another runabout for the use of the water department officials.

### Fire Department

The pace had been set, and in 1906 the fire department introduced one of the first fire-fighting autos in the country, if not the very first. This is termed an auxiliary squad car, designed to carry eight men, a chemical tank, and about thirty pieces of fire-fighting and life-saving appliances.

This machine proved such a success in quickly reaching fires and demonstrating its own efficiency over any kind of horse-drawn apparatus, that the fire department officials were convinced that Springfield was on the right road, and that the auto, as a fire-fighting agency, had come to stay.

A similar squad car was purchased in March, 1907. This was followed by a small touring car for Chief William H. Daggett the following month, and a similar car for First Assistant Chief Everett A. Kimball, later in the same month.

Meanwhile the fire department officials were considering the purchase of a chemical or combination auto, with the result that in August, 1908, a combination chemical and horse auto was placed in service.

THE AUTOMOBILES OF SPRINGFIELD, MASSACHUSETTS.
Group Showing Two Squad Cars, Two Chief's Cars, and Old-Style Hose and Chemical Car.

### Electric Horse Car

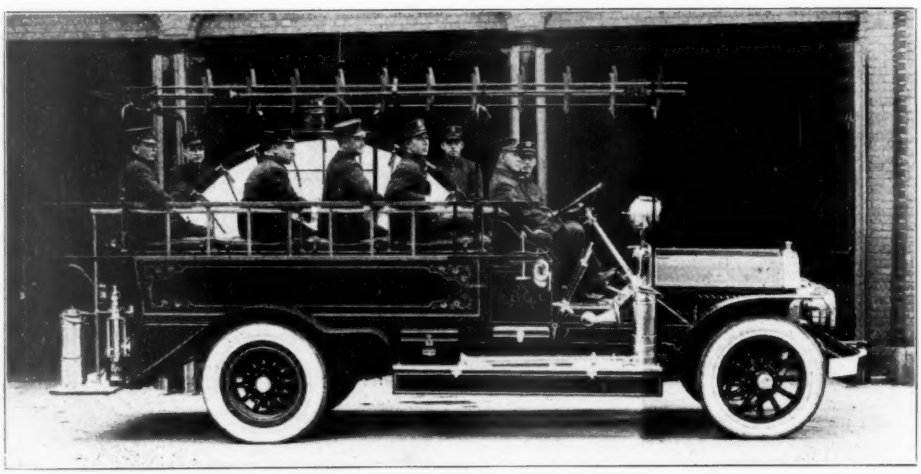
Several other machines were purchased by the fire department in rapid succession until 1910, when it was decided to deviate from the gasoline-driven machine and try an experiment with an electric machine in the form of another combination hose and chemical auto.

The ninth machine in the fire department was this electric combination, which

was placed in service in January, 1911. The first combination car was of the ordinary auto type, with body set low between the wheels, while the eight other combination cars are of the commercial type, with body built high and above the wheels.

This experiment with the electrically-driven combination proved so successful that the fire department the following month put into service the first electrically-driven aerial ladder truck in the country, at a cost of $10,000.

The three-horse aerial ladder truck at headquarters was changed into a motor-driven machine thirteen months later by the adaptation of an electric tractor.



THE AUTOMOBILES OF SPRINGFIELD, MASSACHUSETTS.
Auxiliary Squad "B" Life-Saving Car.

Within a few months after the regular electric truck had been put into service the department decided that a similar machine was necessary, with the result that a second electric truck, at a cost of another $10,000, was put into service last July.

Many other pieces of auto apparatus were installed in the fire department since the first experiment in 1906, the last being a second electric combination, which went into service in August.

At the present time Springfield's fire department is equipped with twenty-two machines, all of which are gasoline autos furnished by the Knox Automobile Company, of Springfield, with the exception of five autos which are electric, these being two electric combinations and three electrically-driven aerial ladder trucks, one of which is tractor driven.

The motor-driven apparatus is made up of nine combinations, three ladder trucks, one water tower, two auxiliary squads, four autos for the chief and three assistant chiefs, two pieces in the fire-alarm department, one a runabout and the other a work car, and one spare gasoline-driven vehicle similar to the squad cars.

### Other City Cars

But the introduction of auto-driven apparatus was not confined to the fire and police departments, although the fire department has played the most prominent part in this comparatively recent innovation.

Their experiments resulted in the departments of street lights, water, highways and parks, and the city property committee adopting automobiles, until at present the water department has six, the highway four, park two, police two, and street-lighting department and city property committee one each.

### Replacements

Since the adoption of motor-driven apparatus by the city the fire department has discarded three machines, the first two auxiliary squads being replaced by

larger cars of the same type, and Chief Daggett's original car being replaced by a larger and more powerful car of similar type.

Squad A, the first car to be introduced into the fire department, was replaced in 1911. This squad, like Squad B, put into service in March, 1907, was a 30-horse-power Knox car, Squad B being replaced in July, 1912, by a 40-horse-power car, the same as Squad A was replaced in 1911. Thus each of the original squads performed service for about six years before being replaced by larger and more powerful autos.

The other cars discarded and replaced were used by the department of street lights and the water department. The first car taken into service by the department of street lighting was a Knox runabout, 18-horse-power, two cylinders, which remained in service from 1904 until 1907, when it was traded for another Knox car, touring design, five passengers, 30-horse-power.

The car discarded by the water department was a Knox runabout, 8-horse-power, single cylinder, which remained in service from 1904 until 1910, when it was traded for a Knox touring car, five passengers, 30-horse-power, four cylinders.

There are several other old autos now in service in various departments, which soon will be replaced by larger cars.

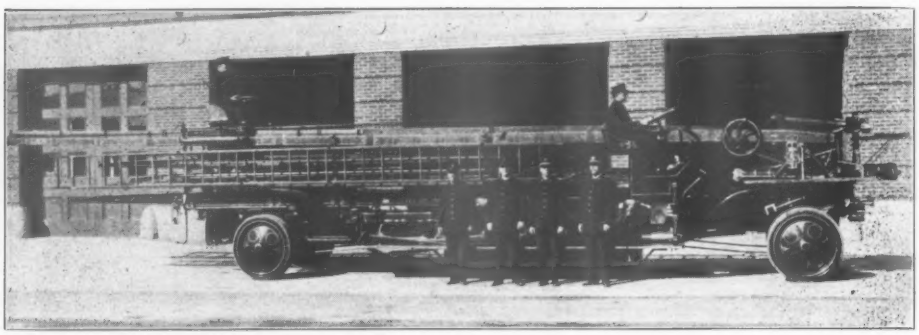
### Water Department

Next to the fire department, the water department leads with the largest number of autos, six now being in service. The second auto, which was a touring car, used by the engineer and superintendent, it is estimated, has covered an average of 10,000 miles a year.

This car was converted into a work car in 1910, and at the present time, with its tonneau removed to provide for a "box" in the rear, it is used for installing and removing meters and other similar work.

The third car to come into the water department was a Knox runabout, four passengers, 30-horse-power, four cylinders, which was used by the superintendent from its installation in 1908 until last year for general purposes, and since last year has been in general use by other employes of the department.

This car was followed by the purchase of a seven-passenger Knox touring car, 40-horse-power, four cylinders, in 1910, for the use of the chief engineer, and since its installation it has held the annual record for mileage, it being estimated from readings of the cyclometer that it covers an average of 15,000 miles a year.



THE AUTOMOBILES OF SPRINGFIELD, MASSACHUSETTS.
Electrically-Driven $10,000 Aerial Ladder Truck.

The next auto in this department came into service in April, 1911, this being a Hudson runabout, four passengers, 22-horse-power, four cylinders, which it is estimated averages 8,000 miles annually. The success of autos induced the department to introduce a three-ton Knox truck, 40-horse-power, four cylinders, into the department in August of this year.

This was followed by the last auto to be purchased by the water department, which is a Cadillac, touring, four-passen-

ger, 30-horse-power, four-cylinder car, which is designed for the use of the superintendent.

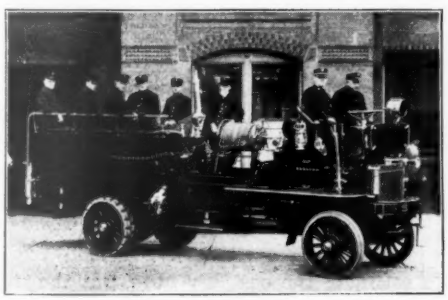
### Highway Department

In the highway department there are now four autos, all of which are of the runabout or touring type, the first machine, which is a Knox runabout, 30-horse-power, four cylinders, coming into the department in 1908. This was used by the superintendent of streets until 1911, since which time it has been used by the paymaster of the department. It is estimated that the yearly average mileage of this machine until 1911 was 7,000 miles.

In June, 1910, the department installed a two-passenger Stanley steamer runabout, 10-horse-power, for the use of the assistant superintendent of streets. This machine is still in service and covers about 12,000 miles a year.

The third machine was of similar make and type, and was put into service the following month. It is used by the superintendent of sewers, and covers about 7,000 miles a year.

The last auto to be purchased by the highway department was a Ford two-passenger runabout, which went into service



THE AUTOMOBILES OF SPRINGFIELD, Combination Hose and Chemical Car, 50-h.p., Gasoline Driven.

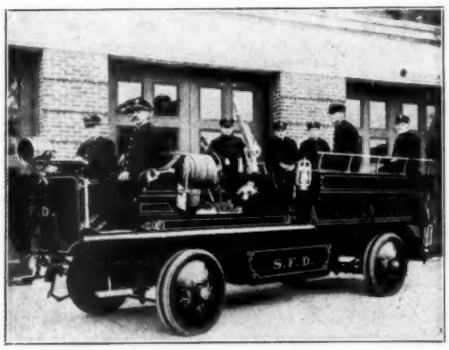
in August of this year, and is used by the superintendent of ashes and garbage.

### Park Department

There are only two machines in the park department, both of these being trucks, the first being a three-ton Knox truck, 45-horse-power, four cylinders, which came into service in February, 1910, and the second being a two-ton truck of similar make and build, which was put into service last February. It is estimated that each of these trucks covers 10,000 miles a year.

### Police Department

Although the police department was in fine condition, so far as its autos were




THE AUTOMOBILES OF SPRINGFIELD, New Electric Combination Car at Headquarters.

concerned, several years ago, it now has the two most inefficient machines in the city, both being antiquated and worn out so completely that breakdowns are a common occurrence on the streets.

The first of these machines went into service in February, 1904. This is a Knox, 14-horse-power, two-cylinder machine, weighing 3,600 pounds, with underslung engine, air-cooled, it being the only example of its kind in the city departments. During the first few years of its service it proved its efficiency, but since April, 1909, when the second police auto went into service, it has proved expensive and burdensome to the drivers, as well as the other members of the department.

The second machine was installed in April, 1909. This is a Knox, 35-horse-power, four cylinders, of the ordinary type, with engine in front instead of underslung beneath body, as in the case of the first machine, yet this last machine, too, being air-cooled and worn out, is as burdensome as the original machine.

### Light and Property Departments

The other departments owning autos are the department of street lights, the superintendent of which operates a Knox touring car, and the schoolhouse agent,

who uses a combination touring car and runabout, purchased for the use of the city property committee, this being a Knox, 30-horse-power, four-cylinder car, which, it is estimated, covers about 4,000 miles a year. The tonneau has been removed from this car and the rear converted into a "box" for commercial purposes. This car was purchased in April, 1910, and is in fine condition.

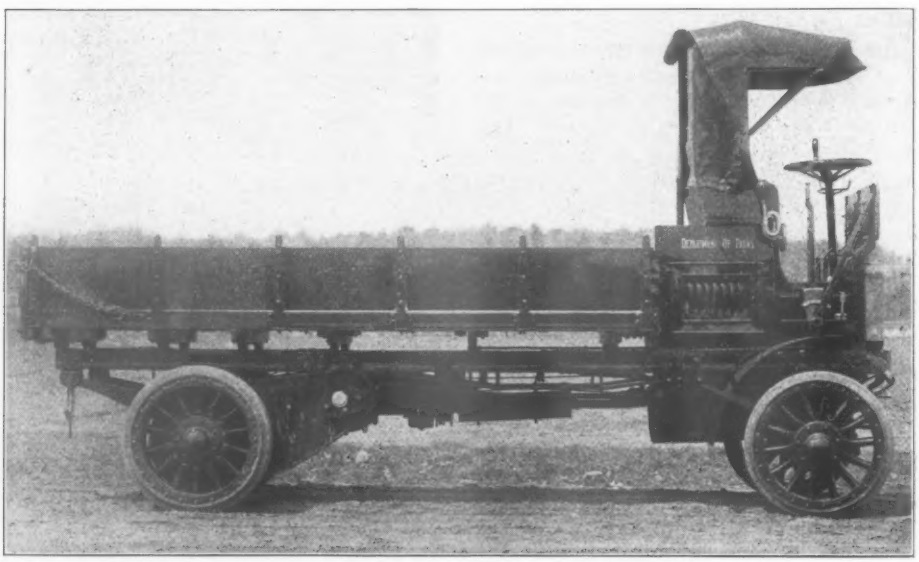
### Comparisons of Cost

Roughly estimated, a three-horse hitch in the fire department costs about $1,000 a year, including forage, etc., horseshoeing, veterinary treatment, and other similar expenses. For a similar piece of apparatus, electrically driven, the fire department estimates a cost of $250 a year, and this estimate is liberal. Thus there is a saving of $750 a year.

Similar figures are offered to show the comparative cost of the two-horse hitch, nine of which horse-drawn pieces of apparatus have been replaced by combination hose and chemical autos, the old chemical engines, so-called, being discarded and replaced by machines which combine both chemical and hose apparatus.

A double-horse hitch costs the department about $650 a year. The modern combination costs approximately $50 a year, and this is a liberal estimate. Thus it will be seen that there is a saving of $600 a year for each combination installed in service, the cost for the electric combinations probably being slightly less than for the gasoline machines.

As a concrete example, the service of hose and chemical combination No. 7, gasoline driven, may be cited. From June, 1911, to June, 1912, this machine made 204 runs at a total cost of $36.44, which is seen to be far below the estimated cost of $650 a year for the two-horse hitch.



THE AUTOMOBILES OF SPRINGFIELD, MASSACHUSETTS.
Truck Used by Park Department.

As none of the fire apparatus is equipped with cyclometers, it is difficult to estimate the cost per mile, but the average mileage for each run, except the squads and autos used by the chief and his three assistants, who respond to very nearly every alarm, is about one mile, which means that most machines do not travel more than 200 or 300 miles a year, a vast difference when compared with the touring and runabout cars in the other departments.

Then, again, another feature of cost must be considered when it is realized that throughout the winter it is customary to keep the gasoline engines running

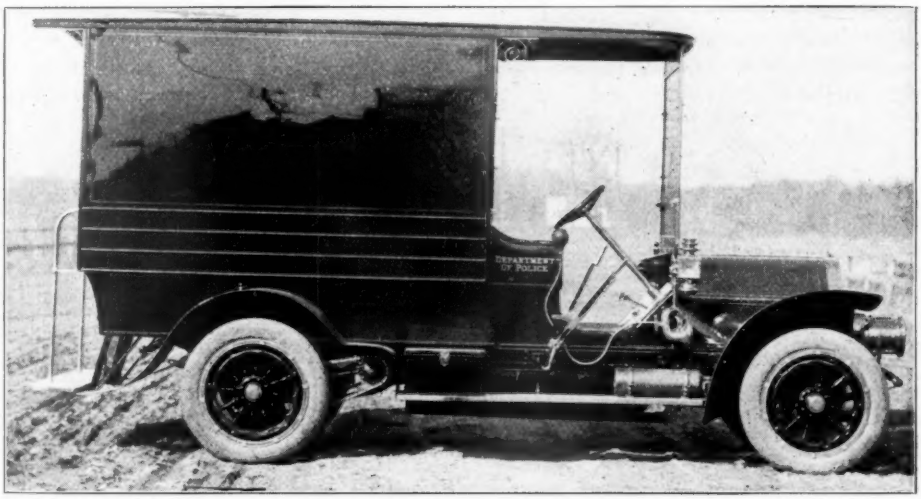
free while extinguishing a fire, for fear of freezing engines. This unavoidable feature costs several hundred dollars in gasoline for the department every year, and demonstrates one of the advantages of electrically-driven apparatus.

Although the mileage of most of the apparatus is comparatively small, the chief of the fire department, as well as his three assistants and the two auxiliary squads, it is estimated, cover from 1,000 to 2,000 miles a year, the chief leading with probably a little more than 3,000 miles each year.

### Expensive Old Cars

Figures furnished by the police department, however, are much greater, the reason for this increase being the worn-out condition of the two cars. For the year 1910 the department expended $1,859 for repairs and supplies on both cars, and in 1911 it cost the department $1,074 for similar expenses, making a total of $2,933 for two years, an average of $1,466 for both machines each year, which means a yearly average of $733 for each machine.

It is estimated that this yearly expense can be reduced 30 or 40 per cent. with




THE AUTOMOBILES OF SPRINGFIELD, MASSACHUSETTS.
The Second Police Patrol in Service.

The success of the motor-driven apparatus in the fire department has resulted in ten of the thirteen fire stations being equipped with at least one piece of such apparatus, the exceptions being the Indian Orchard, Armory and Plainfield street stations.

The cost of operation in the other departments is about the same as may be expected of touring and runabout cars operating each day, summer and winter, those in the water department, it being estimated, averaging $600 each, while the highway department is slightly less.

modern machines, and, regardless of the breakdowns, which are so frequent, this is one of the strong arguments being used by the police department officials in asking for new equipment.

There are several other departments in the city which have appropriated funds for the purchase of automobiles, and with the increase of autos in the departments already equipped, it is expected that in another year Springfield's municipally owned motor-driven apparatus will very nearly touch the 100 mark.

# CHICAGO PLAYGROUNDS.

By Theodore A. Gross, Superintendent Playgrounds and Bathing Beaches, Chicago.

IDEAL playground planning contemplates the establishment of playgrounds close to or in connection with schools. The present movement for school neighborhood centers eventually will place the playground under the same control as that of the schools, and the ideal will have been reached when school and playground, with all their modern activities shall have become one. Because of their great expense in construction and operation, but few cities can emulate the playgrounds of Chicago. When the playgrounds shall be combined with the schools, the movement will spread more rapidly, and it will be possible for every school, even in the small towns and in the country districts, to afford a playground under such a plan.

CHICAGO PLAYGROUNDS.
Girls' Race. Field Day at Dante Playground.

### Playground Equipment

Each playground is equipped with play apparatus, shelters, sand courts, athletic fields, and the larger grounds contain wading pools, running tracks and baseball diamonds.

The formal organized activities, such as baseball leagues, athletic tests, athletic meets, races, exhibitions and play festivals, are given more attention than ever. Among the boys and young men the team spirit is fostered and stimulated in every manner because of the immense educational value of group play in developing co-operation, co-ordination, loyalty, self-denial, and the many other commendable qualities so essential to the development of strong character and the making of good citizenship.

Playground ball, which is practically the regulation indoor baseball game played outdoors, is the most popular game, because it is similar to the national pastime, baseball, which every healthy boy loves to play, and because it can be played in a comparatively small field. This game is played daily at each Chicago playground, and aside from the informal "pick up" games, 1,095 matched games were played during 1911, of which 122 games were played by girls.

A series of tournaments are held in June, July and August. The boys are arranged in two divisions, according to age and height.

### Uses of Equipment

At the Wrightwood, Christopher and McCormick playgrounds the field house contains a large room which is equipped

with light gymnastic apparatus, swinging clubs, wands, dumb bells, mats, kindergarten and industrial work material, and pianos loaned gratis. Women physical training teachers give systematic instruction thruout the entire year to classes of girls and young women each afternoon and two evenings each week in gymnastics, calisthenics, dancing, games, raffia weaving and sewing. The remainder of the time these gymnasiums are occupied by boys and young men engaged in gymnasium work under the leadership of the directors.

The field houses are also utilized as meeting places for boys' and young men's clubs. The meetings are always conducted under the guidance of the directors, the boys receiving a training in parliamentary practice and methods of government. The club rooms are also used by the girls for parties, dances and other social entertainment under the supervision of women instructors.

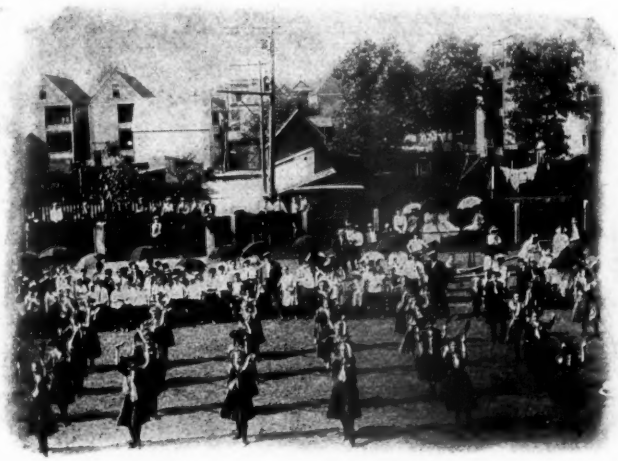
The playgrounds are popular in winter also. On December 1st the greater part of the play apparatus is taken down and stored away, and the grounds are prepared and flooded for skating.

Toboggan slides are erected in the larger playgrounds and have proved to be very popular among those who do not care to skate.

### Free Skates

As hundreds of children patronizing the playgrounds daily during the skating season do not possess ice skates necessary to fully enjoy the pleasure afforded by the flooded ponds, an appeal is made through the public press for discarded skates, which results in collecting nearly one hundred pairs of skates annually which are distributed among the deserving boys and girls or held by the directors and loaned to the children.

However, the demand for skates far exceeds the supply from this source and another method has been employed. The commission conceived a plan whereby these children could be accommodated with skates each season free of charge. Through an appeal for cash contributions sufficient funds were secured to purchase 450 pairs of skates, which were distributed equally among fifteen grounds, providing thirty pairs for each playground. These skates are kept in the possession of the commission and loaned, free of charge, to the patrons each day.



CHICAGO PLAYGROUNDS.
Dedicatory Exercises. Audubon Playground.

### Efficient Directors

The directors employed in each playground to look after the play activities render invaluable service in organizing teams, teaching gymnastics, athletics and games, promoting play in all aspects, insisting on fairness and regard for others,

CHICAGO PLAYGROUNDS.
Girls' Race. Field Day, Adams Playground.

and establishing a feeling of good fellowship among the patrons. It is mostly due to their effective and earnest co-operation that progress is made in organizing and developing the educational play and physical training activities.

The police officers stationed at each ground also render a valuable service in establishing a feeling of safety and confidence. Their method of enforcing public order and maintaining discipline aids in upholding the high standards of efficiency required by the commission.

The general conduct of the patrons of all grounds is satisfactory. The patrons are allowed as much liberty and freedom in the use of the facilities as can be permitted without interfering with the welfare of others. The few repressive rules governing the use of the grounds are rigidly enforced, so that patrons soon learn that they must conduct themselves properly in order to enjoy the privileges of the playground.

The few offenses committed are minor infractions of the rules, the punishment in

CHICAGO PLAYGROUNDS.
Winter Sports. Skating at Hamlin Playground.

each case being temporary suspension. Only 266 girls and 523 boys were penalized in this manner during 1911, which was considerably less than in 1910. The conduct of the older patrons is to be commended and every means is used to encourage parents to visit the playgrounds.

### South Parks Equipment

In each of ten parks of the South Park district there are two indoor gymnasiums, one for men and boys and the other for women and girls. These gymnasiums are equipped with modern apparatus, steel lockers and ample baths. There are also outdoor gymnasiums or playgrounds and at least one baseball diamond in each of the ten parks. All gymnasiums and playgrounds are in care of trained instructors, who conduct classes in gymnastics, dancing and games indoors from October to May, and games, athletics and sports outdoors from May to October. Playground equipment has been selected with special reference to play instincts and tendencies of all groups and ages. Gymnasium classes, sports and pastimes are organized for school children, young working

In connection with the gymnasium and playgrounds of the South Park district, there are ten park building assembly halls, club rooms, reading rooms, refectories, locker rooms and shower baths. The buildings are open for the use of the people every day of the year.

The gymnasium and playgrounds during the school year are open from 3:30 in the afternoon until 10 o'clock at night, except on Saturdays and holidays, when they are open at 10 o'clock in the morning.

The swimming pools are open about June 1 and until about October 1, two days a week being set aside for women and girls.

The shower baths are in use every day in the year.

### Operating Force Required

The force required in each park to operate the facilities named is as follows: 2 gymnasium instructors, one for the women's side and one for the men's side; 2 women attendants for the locker rooms and shower rooms; 3 men attendants; 2 janitors; 1 woman attendant for reading room; 1 playground attendant; 1 fireman; 1 engineer; 2 additional women attendants; 2 additional men attendants; total, 17.

During the swimming season additional attendants are employed as follows: 2 women; 2 men; 2 or 3 life savers, as required by the size of the pool.

The park commissioners furnish bathing suits, towels and soap, for which there is no charge made. Neither is there any charge made for the use of any of the facilities in the building, except in the refectories, where the prices are the very lowest.

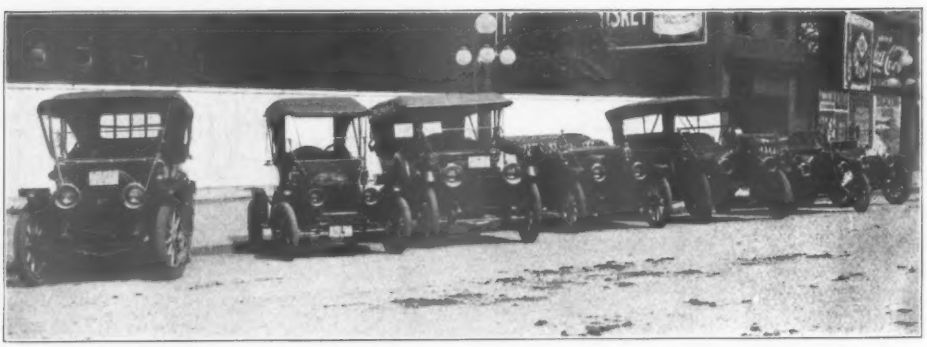
CHICAGO PLAYGROUNDS.
Winter Sports. Toboggan at Hamlin Playground.

# BALTIMORE'S MUNICIPAL MOTORS.

By Stuart Stevens Scott.

THE municipality of Baltimore owns thirty-four automobiles and fourteen motorcycles to do the work of its numerous departments. In spite of the bad streets and heavy grades, the automobile, both for pleasure and business, has found favor and the number is steadily increasing.

Of the municipally owned cars there are eleven in the fire department, twelve in the police department and eleven in what is known as the "city hall," the latter including the departments of sewerage, park board, commissioners for opening streets, paving commission, street cleaning, building inspector, subway, water, health, etc.



BALTIMORE'S MUNICIPAL MOTORS.
Some of the Automobiles Used by Various City Departments.

### Police Department Motors

The introduction of the automobile in the police department was in 1909, when a 60-horsepower Locomobile patrol wagon was put in service. This machine did so well that since then the department has added three more 60-horsepower and five 40-horsepower Locomobiles, so that all of the patrol service in the city is done by automobiles. Besides these machines the marshal has been given a 38-horsepower car, while the linemen of the department have been given a 30-horsepower White gasoline truck. Seven 4-horsepower Indian motorcycles have been put into service for traffic men, completing the motor equipment of the department.

There are on file with the police board elaborate reports from every one of the eight districts showing the mileage, costs of repairs, reports, etc.

In summing up, Morris A. Soper, president of the police board, said: "We find that our machines give us as good service as they would give any other city, considering that our streets are exceedingly hilly, which is hard on engines and tires. Our statistics show that the cost of maintenance of all of the machines in service is equivalent to 12 cents per mile. The statistics of the horse-drawn vehicles, as near as we could figure, puts the mileage at 11 cents per mile.

### Comparison of Motors with Horse Equipment

"On basis of 100,000 miles per year for all of the machines this would appear to be a saving of $1,000 in favor of the horses, but when one considers that there is a difference of seventeen drivers for the machines as against nineteen drivers for the horses, this $1,000 is more than made up.

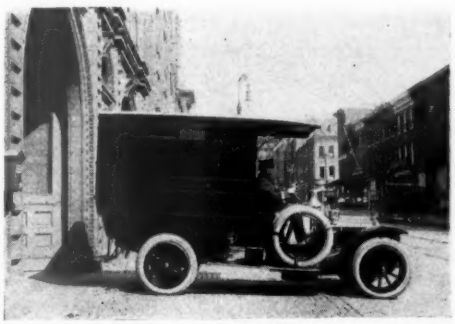
"We have retained our mounted squad for patroling the outskirts of the city, but the motor cycle squad has done what the mounted men have been unable to do —check the speeder. Ten of our motorcycle patrolmen ride in citizen clothes and they have practically a roving detachment, commissioned to go at will thru the city and especially upon those thorofares where the speeder is tempted to try out his machine.

"We have found the automobile our greatest asset for the marshal and his deputy. Formerly it required all day for the deputy to make the rounds of the station houses and inspect them. He now accomplishes his work in the mornings and saves half a day.

"We have materially reduced the cost of maintenance by having our own repair shop. This shop is equipped with lathes and tools by which almost any part of an engine may be made and although it has been open but two years, it has more than paid for itself."

board, is enthusiastic over the automobile in the fire department. He asserts that within a very few years every piece of fire apparatus will be self-propelled. There will be no more horse-drawn pieces of apparatus added to the department in the future. Everything that comes in new will be powered.

The high pressure service trucks are an example of the value of the motors. They are so heavy that six horses would make no speed with them, and yet, under their own power, they not only can make but have made 40 miles an hour.



Fire Department Ambulance.

One of three 40-h.p. Chief's Cars

One of two 60-h.p. High Pressure Trucks.

One of two 40-h.p. Supply Trucks of the Fire Department.

## BALTIMORE'S MUNICIPAL MOTORS.

The fire department has only had automobiles since 1909, when a 40-horsepower White steam car was purchased for the chief. A few months later another car of this type was purchased for the deputy. Now the department has an ambulance, a 40-horsepower White; a supply wagon, a 40-horsepower Mack truck; a 40-horsepower White roadster for the superintendent of machinery; two 60-horsepower Mack trucks in the high pressure service, and two 40-horsepower Mack trucks that are hose wagons.

Richard H. Johns, president of the fire

### Mayor Preston in Favor of the Automobiles

Mayor Preston is conservative yet favorably inclined in his estimate of municipal automobiles. He says:

"Of course every department wants an automobile, but we sometimes have to stop and ask whether it really would be economy to let them have it.

"There is no question about an automobile giving good service if it is used enough and that is usually the question that has to be answered by the department head. If any department chief can

show us that there is actual need for a machine then it is given. For example, the department of lamps and lighting wants a machine. If we ascertain that there is enough work to keep the machine busy we will grant the request.

"The first city department to get a machine was the park board and now there are eleven city departments that have them. All of the cars are of the ordinary pleasure type, touring cars, and they are of different makes. All of them have given satisfaction and their cost of maintenance has been just about what such cars would cost an individual.

"Next year we are going to put the city cars on a different basis. At present the cars are stored at different places, but next year we will have a municipal garage. There will be no such thing as a department car, as all of the cars will be there and at the service of those who need them. This will not only keep the idle cars off the streets, but it will enable the city to save money by having fewer men to look after them and we will have our own repair shops where minor repairs can be made.

"I keenly appreciate the value of the automobile as an adjunct to any line of business. I use a machine regularly, and I venture to say that within a few years there will not be a horse-drawn vehicle in any of the city departments."

### Efficiency of City Jail Motor Van

A power car that has only been in service six months but which has proved itself a most excellent investment is the city jail van, the vehicle in which all of the prisoners are carried between the jail and the Criminal Court. This van is a 30-horsepower White gasoline car and during the time it has been in service it has run more than 15,000 miles on one set of five tires.

"In addition to the speed we also have increased efficiency, for the machine will carry seventeen prisoners whereas the horses could draw but ten at a time and then they could not make more than five miles an hour. The motor van will make twenty miles an hour, up hill and down, loaded to capacity, while on level stretches it will make thirty miles an hour.

Besides having a big touring car the street cleaning department also has seven 4-horsepower Indian motorcycles, which are ridden by inspectors who traverse the city to see that the gangs of street cleaners do their work properly. In former years it was customary for these inspectors to walk and use the street cars, but since the advent of the motorcycle, three years ago, the inspectors have been able to accomplish several times the work they formerly did and as a result of their activities Baltimore is a much cleaner city than it ever was before.

BALTIMORE'S MUNICIPAL MOTORS.
Touring Car and Three of the Inspector's Motorcycles Used by the Street Cleaning Department.

# THE TUSSOCK MOTH.

By J. H. Prost, City Forester, Chicago.

CHICAGO'S civic motto is "Urbs in Horto," which means "a City Set in a Garden." Its citizens should deserve that title by beautifying its streets with trees and shrubbery.

It is encouraging to know that Chicago has fifty or more well organized improvement associations and many other organizations, which have co-operated in various efforts for civic betterment. All these organizations have long realized that more attention should be given to tree

THE TUSSOCK MOTH.
Cocoons and Egg Masses.

planting. They appreciated the fact that the tree is not only an indispensable factor in making the city more beautiful, but a necessity and essential to an ideal residence street.

Washington is considered the most beautiful city in America. Every visitor to the Capital is impressed by the prominence and grandeur of its trees. These trees form attractive backgrounds, which enhance the dignity of every statue and frame every residence in a fringe of green.

Numerous inquiries and complaints have been received by the Special Park Commission of Chicago relative to the ravages of the larvae or caterpillars of the White Marked Tussock Moth (Orygia Leucostigma). Citizens and improvement associations have been urged to carry on a continual warfare against this pest, destroying it in any form wherever found.

### The Caterpillars

When the larva of this insect is fully developed it is one of the most beautiful of our caterpillars, being characteristic in appearance (See Figure 3). The larva or caterpillar is easily recognized by its bright red head and the velvety black back, bordered with yellow stripes. Four conspicuous tufts of cream-colored hair are found growing straight up on the dorsal aspect of the abdominal segments and a pair of long black pencil-like plumes extend forward from the head at an angle from the body and a single one extends back from the posterior end of the body.

### The Larvae

When first hatched the young larvae migrate to the under sides of the leaves, where they feed upon the chlorophyl, or green matter of the leaf, often completely defoliating the tree.

After the larvae are about four weeks old they begin to migrate to the crevices of the tree trunk, to fences, walls, porches, eaves and other protected places.

Figure 1.

Figure 2.

THE TUSSOCK MOTH.

Here they spin cocoons composed of the silky threads, which are easily distinguished, and in these the insect changes from the larva to the pupa stage and from the pupa to the adult stage.

### The Moths

The male adult (See Figure 2) is a brown colored moth with two pairs of wings, while the female (See Figure 1) is a sluglike moth with wings. Soon after emerging from the pupa the female crawls upon her cocoon and after mating she deposits her eggs on the empty co-

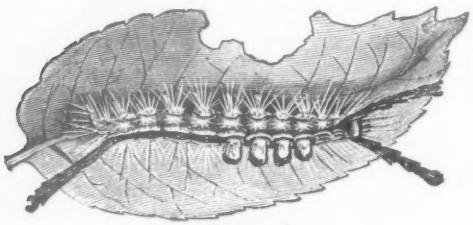


Figure 3.
THE TUSSOCK MOTH.

coons, covering them with a conspicuous mass of white frothy wax.

Many insect pests infest the caterpillars and do much toward controlling this pest, while our native birds, wherever they exist, feed upon the young larvae.

### Destroying the Pest

Spraying the young foliage early in the spring with arsenate of lead, in proportions of four pounds of lead to fifty gallons of water, is one of the best methods of combating this pest. This insecticide must be carefully applied and thoroly understood.

Citizens can do a great deal individually by destroying the larvae. This can easily be accomplished by squashing or crushing the pupa which are hidden in the cocoons and by gathering the egg masses and burning them. The crushing can be done by poking a stick against the cocoons or by using long poles, where the cocoons are up in the trees. This is the most simple and economical way of combating the pest. When the tree has been cleared of the egg masses and caterpillars, re-infestation may, in a great measure, be prevented by placing a band of "tanglefoot" or cotton batting around the trunk, for the insect can only spread while in the larva stage.

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## PHAROS AIR PRESSURE GAS LAMP.

By Leonard Keene Hirshberg, A. B., M. A., M. D., John Hopkins.

IN recognition of the success which has followed the introduction into Marseilles, Bordeaux, Paris, and other European cities, of a high-powered incandescent system of gas illumination, Mr. McCuen, the commissioner for lighting streets in the city of Baltimore, has planned a trial of the new method in the Monumental City. The old scheme, now in universal use, is dependent for increased gas light upon numerous extra burners, while the French system, on the other hand, involves the use of increased pressure of either or both air and gas and the laying of special mains containing air under high pressure. These mains run parallel to the others and the gas is sent through at ordinary pressures.

This combination gives a much higher candle power at the burner, and at the same time permits more gas to emerge from the tip. Thus the gas light equals in brilliancy and intensity the electric arc. Economically, it is claimed abroad, the new combination of gas and compressed air gives the luminosity of an arc at the cost of a little above the ordinary gas mantle.

In Paris they have already extended the new system throughout the Boulevard de l'Opera, and the type of lamp is a cluster of three inverted burners. Each group of three emits a candle power of 1,500, raised twenty feet above the roadway. An automatic stopcock and button arrangement reacts spontaneously to certain pressures within the central gas station, thus extinguishing and also turning on the gas burners, without the need of city lamp lighters. A few inspectors are employed, however, in order to cut out and repair any injured or defective burners, and this exigency is met by providing all lamps with separate valves and keys for lighting or putting them out when necessary.

The inspectors also clean the lamps and

examine them twice each week. At that time new mantles are adjusted, and broken globes, if any, are replaced. An idea of the saving from the use of such lamps may be derived from the statement that 5,000-candle-power lamps cost 10 cents an hour, or in winter about one dollar a night per lamp. For an equivalent 5,000-candle-power arc lamp the cost each night with electricity, at 70 cents an hour (five kilowatt hours times 14 cents), the city must pay seven dollars for each arc, or ten times the cost of the high-pressure gas lamp.

## A GERMAN STREET SWEEPER.

**By Dr. Robert Grimshaw, Dresden, Germany.**

THE sweeping machine made by the Frankfurter Kehrmaschienen Fabrik is distinguished from the majority of apparatus for the same purpose in that the cylindrical brush can move independently of the general frame of the machine, so that instead of letting dirt lie in the low places, which one is sure to find on the street surface, and which must be removed by hand-sweeping, the brush goes down into these low places, without, however, having to be pressed into them so firmly that one horse can hardly haul the machine. In case this "remedy" is resorted to, the wear and tear of the brush is greatly increased; furthermore, the street covering—especially with macadam and telford roads—is unnecessarily worn.

The "Cardamus" two-wheeled machine here illustrated has the brush frame hung on a hollow axle to the main running-gear frame, so that it can rotate about this axle, as well as about that of the wheels, this permitting a movement equivalent to one about two axes cutting each other perpendicularly in a plane. For this reason the main frame can take any position whatever, without influencing that of the brush and its frame, the brush pressing the street surface with its own weight only. The brush, which lies diagonally to the machine, rotates in the opposite direction to the running-gear wheels. It is driven by shaft, bevel gears and chain from the last-named wheels, each of which is mounted on a common axle. All these parts run in a dust-tight oil bath. The main wheel bearings are long; all others are steel ball bearings, protected by felt rings from dust. The machine makes almost no noise when running. It weighs 490 kg. (1,078 lbs.), has a brush 200 cm. (79 inches) long, sweeping a path 190 cm. (75 inches) wide. When drawn by one horse it sweeps about 6,500 square meters (70,000 square feet) of street an hour. On level streets it can be drawn by any ordinary horse; on grades of 10 per cent., by a good stout one.

A special machine, made by the same firm, for forest roads in mountain districts, weighs 400 kg. (800 lbs.), has a brush 150 cm. (59 inches) long, sweeping its full width and covering about 4,500 square meters (48,400 square feet) an hour. The roller is adjustable, so that it can sweep to right or left as desired, this being necessary on all mountain roads. The brush stands out laterally from the main wheel on the side toward which it sweeps. The main wheels track 100 cm. (40 inches) wide. The adjustability of the brush enables the machine to sweep roads only 40 inches wide, altho the brush is 60 inches long. The brush being held to the road surface by its own weight only, conforms to all inequalities of the surface.

A GERMAN STREET SWEEPER.
Note the Brush Axle Is Independent of the Cart Axle.